

Review

**Landsat 7 OR Distribution
Product**

**Data Format Control Book
Volume 5**

HDF Version

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1.0 INTRODUCTION

1.1 Identification

This is the Data Format Control Book for the Landsat 7 OR Distribution Product available from the EROS Data Center Distributed Active Archive Center (EDC-DAAC) in Hierarchical Data Format (HDF).

1.2 Product Overview

Unlike earlier Landsat programs, the Landsat 7 system was not designed to produce high level products for users although a limited systematic correction capability has been added to the ground system. The primary user product is OR data - an essentially raw data form that is marginally useful prior to radiometric and geometric correction. A Landsat 7 product, however, does contain all the ancillary data required to perform these corrections including a calibration parameter file (CPF) generated by the Landsat 7 Image Assessment System (IAS). This file is updated at least four times a year and provides users with enhanced processing parameters for producing rectified image data of superior quality.

The product delivered to Landsat 7 data users is packaged in HDF - an open standard selected by NASA for Earth Observing System (EOS) data products. HDF is a self-describing format that allows an application to interpret the structure and contents of a file without outside information. HDF allows Landsat OR products to be shared across different computer platforms without modification and is supported by a public domain software library consisting of access tools and various utilities.

1.3 Purpose

The purpose of this document is to provide users with a high level description of the OR distribution product, the HDF structuring mechanisms employed, and a detailed layout of the image and ancillary data formats. Relevant HDF library routines and example OR ingest programs conclude this document.

The focus of this document is on the HDF format of the OR product. To make full use of the data, the reader should also obtain the Landsat 7 Science Data User's Guide.

1.4 Applicable Documents

The documents listed below offer additional details regarding the Landsat Processing System (LPS) and its output data formats, HDF as designed by National Center for Supercomputer Applications (NCSA), and the EOS extensions to HDF.

1.4.1 Goddard Space Flight Center, Code 514.1, Landsat 7 Processing System (LPS) Output Files Data Format Control Book, November 1995.

1.4.2 Lockheed Martin Missiles and Space, Landsat 7 System Data Format Control Book (DFCB), Volume IV - Wideband Data, Revision C, 23007702-IVC, April 4, 1996.

1.4.3 Hughes Applied Information Systems, Inc., HDF-EOS Primer for Version 1, EOSDIS, White Paper, 175-WK-001-001, April 1995.

1.4.4 Hughes Applied Information Systems, Inc., The HDF-EOS Swath Concept, White Paper, WBS-WP-xxx-yyy (TBD), June 1995.

1.4.5 Jet Propulsion Laboratory, California Institute of Technology, Planetary Data System Standards Reference, Chapter 12, Object Description Language Specification and Usage, Version 3.2, July 24, 1995
URL: <http://pds.jpl.nasa.gov/stdref/chap12.htm>

1.4.6 CCSDS, 641.0-G-1, The Parameter Value Language - A Tutorial, May 1992.

1.4.7 University of Illinois at Urbana-Champaign, National Center for Supercomputing Applications (NCSA), Getting Started with HDF, Version 3.2, May 1993.
URL: <http://hdf.ncsa.uiuc.edu/doc.html>

1.4.8 University of Illinois at Urbana-Champaign, National Center for Supercomputing Applications (NCSA), HDF User's Guide, June 1996. URL: <http://hdf.ncsa.uiuc.edu/doc.html>

1.4.9 University of Illinois at Urbana-Champaign, National Center for Supercomputing Applications (NCSA), HDF Specification and Developer's Guide, Version 3.2, September 1993.
URL: <http://hdf.ncsa.uiuc.edu/doc.html>

1.4.10 University of Illinois at Urbana-Champaign, National Center for Supercomputing Applications (NCSA), HDF Reference Manual, Version 3.3, February, 1994.
URL: <http://hdf.ncsa.uiuc.edu/doc.html>

1.4.11 Landsat 7 Science Data User's Guide (in work, first draft available 6/97)

2.0 PRE-ARCHIVE PROCESSING

A brief look at the pre-archive ground processing is necessary to appreciate the nature of the OR product.

The Landsat Ground Station (LGS) acquires enhanced thematic mapper (ETM+) wideband data directly from the Landsat 7 spacecraft via two 150 Mbps X-band return links, separates each X-band data into two 75 Mbps channels (I and Q) and transmits the acquired wideband data over four 75 Mbps LGS output channels to the LPS. The LPS records all wideband data, at real-time rates, into its wideband data stores. A complete data set is represented by an I-Q channel pair. One channel holds bands 1 through 6 and the other bands 7, 8 and a high gain form of band 6.

The LPS retrieves and processes each channel of raw wideband data, at lower than real-time rates, into separate accumulations of earth image data, calibration data, mirror scan correction data (MSCD), and Payload Correction Data (PCD). Channel accumulations represented by bands 1-6 and 6-8 become formats 1 and 2 respectively. PCD and MSCD are generated twice, once for each format. Their content should be identical.

LPS spatially reformats earth imagery and calibration data into Level OR data. This involves shifting pixels by integer amounts to account for the alternating forward-reverse scanning pattern of the ETM+ sensor, the odd-even detector arrangement within each band, and the detector offsets inherent to the focal plane array engineering design. All LPS OR corrections are reversible; the pixel shift parameters used are documented in the calibration parameter file.

During LPS processing, format 1 bands are duplicated, radiometrically corrected, and used to assess cloud cover content and to generate browse. Cloud cover scores are generated on a scene by scene and quadrant by quadrant basis. Metadata is generated for the entire subinterval and on a scene by scene basis. The image data, PCD, MSCD, calibration data, and metadata is structured into HDF for each format and sent

to the EDC-DAAC for archiving in subinterval form. The two formats of data are united when a Landsat 7 0R product is ordered. The browse is sent to the EDC-DAAC separately for use as an online aid to ordering.

3.0 PRODUCT TYPES

Three sizing options, depicted in Figure 3.1, are available to a user when defining the size or spatial extent of a Landsat level 0R product ordered from the EDC-DAAC.

3.1 Standard Worldwide Reference System (WRS) Scene. The standard WRS scene as defined for Landsats 4 and 5 was preserved as an orderable product for Landsat 7. The WRS indexes orbits (paths) and scene centers (rows) into a global grid system comprising 233 paths by 248 rows. The path/row notation was originally employed to provide a standard designator for every nominal scene center and allow straight forward referencing without using longitude and latitude coordinates.

The distance between WRS center points along a path is 161.1 kilometers. A path distance of 85 kilometers before and after a WRS center point defines the standard scene length or ground distance of 170 km. The standard WRS scene overlaps neighboring scenes along a path by 5% and has a width or cross track distance of 185 km.

Landsat 7 browse is framed according to WRS scenes. An ordered scene will cover the same geographic extent observed in the browse. Standard WRS scenes have 374 scans. Partial scenes (greater than 90 scans but less than 374) may exist at the beginning or end of a subinterval due to the fact that imaging events do not always start on scene boundaries. Browse and scene metadata for these occurrences accurately reflect their partial scene nature and geographic extent.

3.2 Subinterval. A subinterval of Landsat 7 data can be ordered in its entirety. An interval is a scheduled ETM+ image period along a WRS path, and may be from one to 35 scenes in length. A subinterval is a contiguous segment of raw wideband data received during a Landsat 7 contact period. Subintervals are caused by breaks in the wideband data stream due to communication dropouts and/or the inability of the spacecraft to transmit a complete observation (interval) within a single Landsat 7 contact period. The largest possible subinterval is 35 scenes long. The smallest possible subinterval is a single ETM+ scene.

3.3 Partial Subinterval

A partial Landsat 7 subinterval can also be ordered. The partial subinterval is dimensioned according to standard WRS scene width, is at least one a quarter WRS scene in length (i.e. 90 scans), and can be up to an entire subinterval in length. A partial subinterval can float or be positioned at any scan starting point within a subinterval. Partial subintervals are defined by either specifying contiguous WRS locations or defining a bounding longitude/latitude rectangle on a computerized map display. In the latter case, all scans touched by the bounding rectangle are included in their entirety.

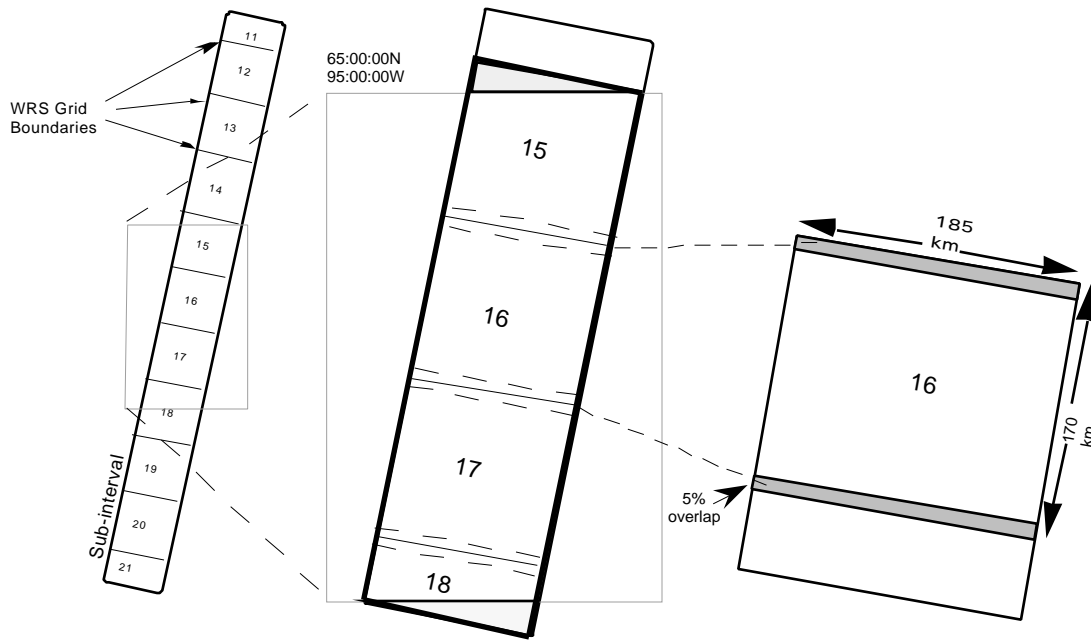


Figure 3.1. 0R Product Types

4.0 PRODUCT CONTENT OVERVIEW

A complete scene-sized 0R product ordered from the EDC-DAAC consists of 19 data sets derived from the wideband telemetry, an IAS-generated calibration parameter file, a product specific metadata file and a geolocation index generated by ECS, and an HDF directory. A brief description of each follows.

1 - 9. Earth Image Data - The unique bands of ETM+ image data comprise nine of the data sets. The data is laid out in a scan line sequential format in ascending detector order (i.e. detector one followed by detector two and so on). Individual band characteristics are listed in Table 4.1. Band 6 is captured twice - once in low and the other in high gain mode.

Band #	Wavelength (µm)	Resolution (meters)	Data Lines per Scan	Data Line Length (bytes)	Bits per Sample
1	.450 - .515	30	16	6,600	8
2	.525 - .605	30	16	6,600	8
3	.630 - .690	30	16	6,600	8
4	.775 - .900	30	16	6,600	8
5	1.550 - 1.750	30	16	6,600	8
6L	10.40 - 12.50	60	8	3,300	8
6H	10.40 - 12.50	60	8	3,300	8
7	2.090 - 2.35	30	16	6,600	8
8	.520 - .900	15	32	13,200	8

Table 4.1 ETM+ band characteristics

10. Internal calibrator (IC) data - format 1 - IC data for format 1 consists of scan line ordered internal lamp and shutter data for bands 1-5 and blackbody radiance and shutter data for low gain band

6. The data is collected once per scan and structured in a band sequential format in ascending detector order (i.e. detector one followed by detector two and so on).

11. Internal calibrator (IC) data - format 2 - IC data for format 2 consists of scan ordered internal lamp and shutter data for bands 7 and 8 and blackbody radiance and shutter data for high gain band 6. The data is collected once per scan and structured in a band sequential format in ascending detector order (i.e. detector one followed by detector two and so on).

12. MSCD - format 1. A logical record of MSCD exists for each data scan present in the 0R product ordered. Each logical record consists of 3 MSCD data values - the first half scan error, the second half scan error, and the scan line direction. This information is used to compute deviations from nominal scan mirror profiles as measured on the ground and reported in the calibration parameter file. Also included in the MSCD file are scan based values such as time code, gain status and processing errors encountered by LPS. The MSCD is trimmed to fit the product ordered (i.e. same number of MSCD logical records as scans in the ordered product).

13. MSCD - format 2. A duplicate set of MSCD is generated when format 2 is processed and is kept with the product in the event format 1 is lost or corrupted.

14. PCD - format 1 The PCD for format 1 consists of attitude and ephemeris profiles as well high frequency jitter measurements. PCD for the entire subinterval is included with the 0R product regardless of the size of the data set ordered.

15. PCD - format 2 A duplicate set of PCD is generated when format 2 is processed and is kept with the product in the event format 1 is lost or corrupted.

16. Scan line offsets - format 1. During LPS processing image data is shifted in an extended buffer to account for predetermined detector and band shifts, scan line length, and possible bumper wear. The scan line offsets represent the actual starting and ending pixel positions for valid (non-zero fill) data on a data line by data line basis for bands 1 through 6 low gain.

17. Scan line offsets - format 2. During LPS processing image data is shifted in an extended buffer to account for predetermined detector and band shifts, scan line length, and possible bumper wear. The scan line offsets represent the actual starting and ending pixel positions for valid (non-zero fill) data on a data line by data line basis for bands 6 high gain through 8.

18. Metadata - format 1. During LPS format 1 processing metadata is generated that characterizes the subinterval's spatial extent, content, and data quality for bands 1 through 6 low gain. This file, in its entirety and original form, accompanies the 0R product.

19. Metadata - format 2. Format 2 metadata is similar but not identical to format 1 metadata. The subinterval-related metadata contents are identical; the scene-related metadata is specific to bands 6 - high gain, 7, and 8. Also, the format 2 metadata does not include cloud cover assessment data or references to browse data products.

20. Metadata - ECS. A third metadata file generated by ECS during order processing. This file contains product specific information such as corner coordinates and number of scans.

21. Geolocation Index. The geolocation index is also produced by ECS. This table contains scene corner coordinates and their product-specific scan line numbers for bands at all three resolutions. Its purpose is provide for efficient subsetting of a 0R product.

22. Calibration parameters. The IAS regularly updates the CPF to reflect changing radiometric and geometric parameters required for level 1 processing. These are stamped with applicability dates and sent to the EDC-DAAC for storage and bundling with outbound 0R products.

23. HDF Directory. A file containing all the pointers, file size information, and data objects required to open and process the 0R product using the HDF library and interface routines.

A user may order a subset of the available bands which will affect the actual file count in a 0R product. In all cases, however, every product includes two PCD files, two MSCD files, three metadata files, the CPF, and the HDF directory. Only the internal calibrator, scan line offset, and earth image file counts are impacted by a product possessing less than the full complement of bands.

5.0 DATA DEFINITION

5.1 HDF Conventions

5.1.1 File Structure

The 0R product files are created using the HDF-EOS function library developed by NCSA and extended by NASA for EOS-era products. All files are simple byte streams. There are no data records as such. Information about the basic structure of HDF files can be found in various NCSA and NASA publications listed under Applicable Documents.

New users should begin with *Getting Started with HDF*, which provides an introduction to the concepts used in HDF file design and programming and will give the reader an appreciation for the design philosophy of the HDF software and file structure. Additionally, the *HDF User's Guide* and *HDF Reference Manual* are excellent resources for the HDF programmer. More advanced users can read *NCSA HDF Specifications and Developer's Guide* to learn about the low-level structure of HDF files.

5.1.2 Data Definition Terminology

Data structures are referred to using HDF terminology. Descriptions of structures relevant to the 0R product follow:

Scientific Data Set (SDS) - An array of data of any fixed dimensionality (rank) from 1 to 32767 and any one data type.

Vdata - A record based structure where values are stored in fixed-length fields. Fields are defined, named, and typed individually. All records within a Vdata are identical in structure.

Vgroup - A structure for associating sets of data objects. Vgroups define logical relationships and may contain any HDF objects, including other Vgroups.

Attribute - A named value or list of values, all of the same data type. HDF attributes are used to store product metadata in the form of character strings. Attributes are affixed to either the entire file or individual SDSs.

External Element - Data that are stored in a separate file, external to the basic HDF file. External elements allow for larger product sizes (i.e. up to 12 scenes), and the ability to read 0R products without using the HDF library.

5.1.3 Data Representation

Data are both binary and ASCII. Bit and byte ordering follow the Institute of Electrical and Electronics Engineers (IEEE) conventions. The term byte is synonymous with octet as used by the International Organization for Standardization (ISO).

5.1.4 Notation

Storage types are referred to using HDF number type nomenclature:

type#

where type is either char (character), int (integer), or float (floating point), and # is a decimal count of the number of bits used to represent the data type. The type mnemonics *int* and *char* may be preceded by the letter u, indicating an unsigned value. For example, the data type *uint32* refers to an unsigned 32-bit integer value.

Storage types relevant to the 0R product are:

Data Type	HDF Nomenclature
8 bit character	char8
8 bit unsigned integer	uint8
16 bit signed integer	int16
16 bit unsigned integer	unt16
32 bit signed integer	int32
32 bit floating point number	float32
64 bit floating point number	float64

5.2 Structure Overview

The 0R product is packaged and distributed as a collection of external elements with an HDF data directory. It can be as large as 35 scenes or as small as a 90 scan quarter scene. External elements are distinguished by the fact that they exist as separate files and contain only data. Information about their HDF structure and inter-relationships are defined in the HDF directory.

The number of files or external elements comprising a 0R product can vary according to product size (e.g. partial subinterval, subinterval) and the number of bands ordered. Assuming both subinterval formats have been archived the following 10 files always accompany a 0R product:

- | | |
|-----------------------|-------------------------------|
| 1. HDF Data Directory | 6. Metadata - format 1 |
| 2. MSCD - format 1 | 7. Metadata - format 2 |
| 3. MSCD - format 2 | 8. Metadata - ECS specific |
| 4. PCD - format 1 | 9. Calibration Parameter file |
| 5. PCD - format 2 | 10. Geolocation Index |

The earth image data, IC data, and the scan line offset product components affect the file total in the following ways:

- Each earth image band ordered is self contained in a single file. The lone exception to this one file per band rule comes about whenever a partial subinterval is ordered that is both greater than 12 scenes and includes the panchromatic band. Due to an HDF file size restriction the panchromatic band must be allocated to 2GB files. A 35 scene subinterval would thus require 3 such files or image segments.
- During LPS processing, IC bands 1 through 6L are arranged in band sequential order in one file while bands 6H through 8 are arranged in similar fashion in a second file. The IC data is subset according to bands ordered yet adheres to the band sequential two file arrangement. For example, a product consisting of just one band would have a single IC file containing that band's pulse and shutter data. A product of 9 bands includes the full complement of IC data in two files. And a product with only two bands has two IC files with a single band each.
- Also during LPS processing the starting and ending pixel numbers or scan line offsets are computed on a data line by data line basis for each band. These are stored in a separate file for each band by LPS but are repackaged by ECS in a band sequential 2 file arrangement similar to the IC data. The scan line offsets that accompany a 0R product are specific to ordered bands only.

The collection of external elements that comprise a complete single scene 0R product is conceptualized in Figures 1. The 9 bands of earth image data are represented by 9 SDS external elements. Bands sharing a common ground resolution are logically associated using the Vgroup data structure. Three Vgroups result; bands 1-5 and 7, bands 6-low and 6-high, and band 8.

The 9 bands of IC data follow an identical structure. Three groups are formed based on a common ground resolution. Two external elements are used to store the IC data. One file contains bands 1 through 6-low and the other bands 6-high, 7 and 8.

The scan line offsets from format 1 and 2 are stored as two Vdata tables. One file contains the offsets for bands 1 through 6-low and the other bands 6-high through 8. The Vdata for each band is logically associated with its corresponding earth image and IC SDS.

One geolocation index Vdata accompanies the product. Although the geolocation Vdata exists as a separate file it is logically associated with each image and IC band using the Vgroup data structure.

The MSCD from format 1 and 2 are stored as 2 Vdata tables and logically grouped using the Vgroup data structure.

The PCD from formats 1 and 2 are stored as Vdata tables and are also logically united.

The product also contains the two LPS-generated metadata files and an ECS-generated metadata file that is crafted during product generation. Metadata are stored as global character string attributes in the Objective Description Language (ODL) syntax.

The last element of the file is the IAS generated calibration parameters. Calibration parameters are stored as global character string attributes using the ODL syntax.

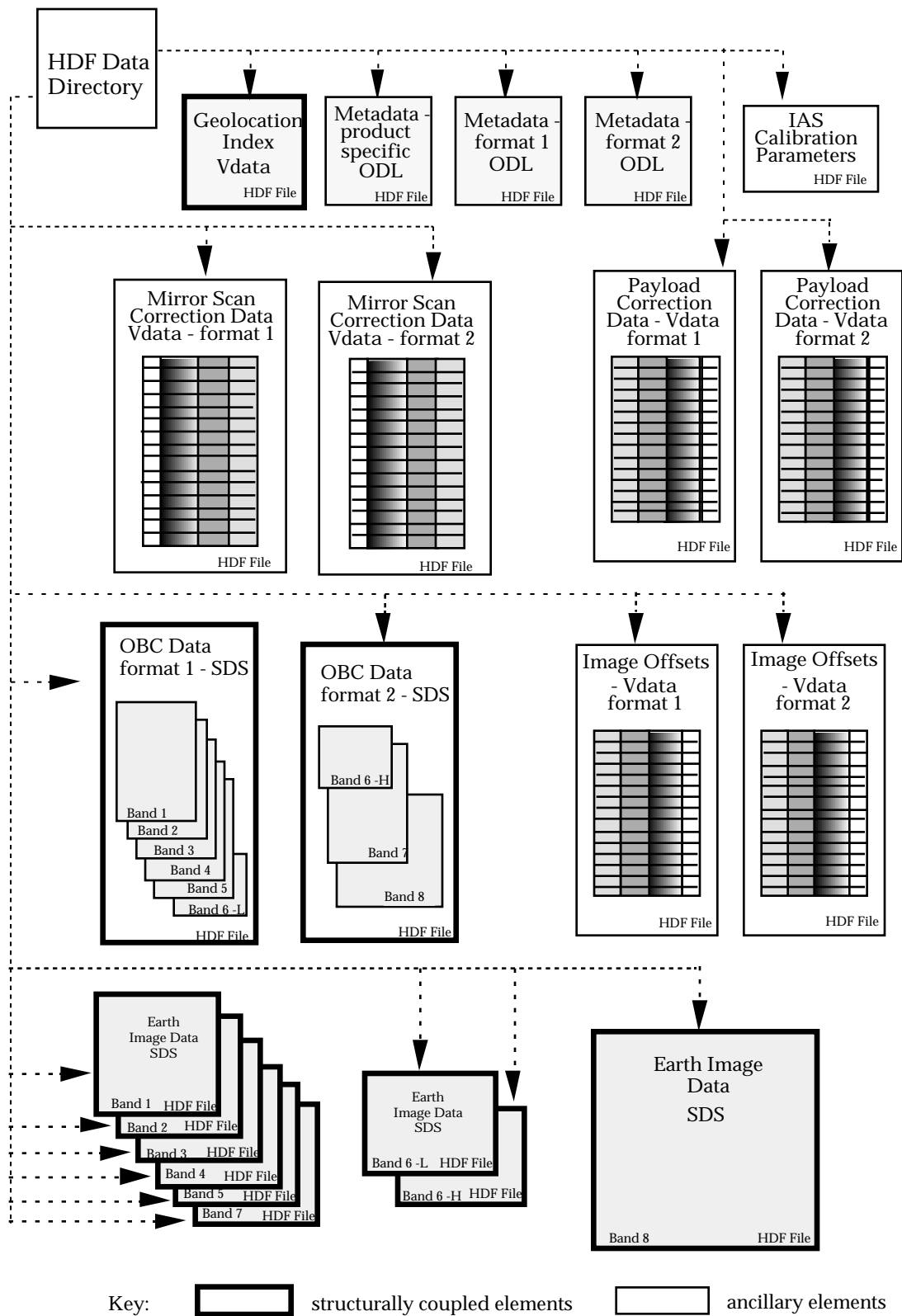


Figure 2. A complete OR scene product - External Elements

5.3 Detailed Structure

5.3.1 Naming Conventions

The HDF data structure names are derived using the LPS file naming notation:

L7sssfnYYDOYHHuuv.xxx

where

L7 indicates the Landsat 7 mission

X = 1, 2, or 3 for the L7 X-band used to downlink data to the LGS

sss indicates ground station such as EDC at Sioux Falls or ANC for Anchorage

f indicates ETM+ data format (1 or 2), The geolocation table defaults to 1.

n indicates LPS processor number (1-9)

YY indicates last two digits of the year associated with a contact period (not acquisition time)

DOY = Julian day of the contact period

HH = hour of the contact period within a 24 hour day (00-23)

uu indicates a subinterval number within this contact period (00-99)

v indicates dataset version number (v = 0 for original or 1-9 for reprocessed data)

xxx indicates the type of data (MSD for MSCD, PCD for PCD, GEO for the geolocation index B10 through B83 for earth image data, C10 through C80 for the IC data and O10 - O80 for the scan line offsets)

5.3.2 SDS Definitions

ETM+ imagery, both Earth and calibration data, is structured as SDSs. Table 5.1 lists the individual SDSs that compose the 0R product.

No.	SDS Name	Description	Number Type	Rank	Dimensions
1	L7sss1nYYDOYHHuuv.B10	SDS containing 30 meter ETM+ band 1 earth image data	uint8	2	Scan line count * 16 by 6600 (row major)
2	L7sss1nYYDOYHHuuv.B20	SDS containing 30 meter ETM+ band 2 earth image data	uint8	2	Scan line count * 16 by 6600 (row major)
3	L7sss1nYYDOYHHuuv.B30	SDS containing 30 meter ETM+ band 3 earth image data	uint8	2	Scan line count * 16 by 6600 (row major)
4	L7sss1nYYDOYHHuuv.B40	SDS containing 30 meter ETM+ band 4 earth image data	uint8	2	Scan line count * 16 by 6600 (row major)
5	L7sss1nYYDOYHHuuv.B50	SDS containing 30 meter ETM+ band 5 earth image data	uint8	2	Scan line count * 16 by 6600 (row major)
6	L7sss1nYYDOYHHuuv.B60	SDS containing 60 meter ETM+ band 6 low gain earth image data	uint8	2	Scan line count * 8 by 3300 (row major)
7	L7sss2nYYDOYHHuuv.B60	SDS containing 60 meter ETM+ band 6 high gain earth image data	uint8	2	Scan line count * 8 by 3300 (row major)
8	L7sss1nYYDOYHHuuv.B70	SDS containing 30 meter ETM+ band 7 earth imagery	uint8	2	Scan line count * 16 by 6600 (row major)
9	L7sss2nYYDOYHHuuv.B80	SDS containing 15 meter ETM+ band 7 earth image data.	uint8	2	Scan line count * 32 by 13200 (row major)
8	L7sss2nYYDOYHHuuv.B81	SDS containing ETM+ band 8 15m data, two or more segment product	uint8	2	Scan line count * 16 by 6600 (row major)

8	L7sss2nYYDOYHHuuv.B82	SDS containing ETM+ band 8 15m data, two or more segment product	uint8	2	Scan line count * 16 by 6600 (row major)
9	L7sss2nYYDOYHHuuv.B83	SDS containing ETM+ band 8 15m data, three segment product	uint8	2	Scan line count * 32 by 13200 (row major)
10	L7sss1nYYDOYHHuuv.C10	SDS containing ETM+ band 1 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
11	L7sss1nYYDOYHHuuv.C20	SDS containing ETM+ band 2 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
12	L7sss1nYYDOYHHuuv.C30	SDS containing ETM+ band 3 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
13	L7sss1nYYDOYHHuuv.C40	SDS containing ETM+ band 4 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
14	L7sss1nYYDOYHHuuv.C50	SDS containing ETM+ band 5 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
15	L7sss1nYYDOYHHuuv.C60	SDS containing ETM+ band 6L calibration data	uint8	2	Scan line count * 8 by 580 (row major)
16	L7sss2nYYDOYHHuuv.C60	SDS containing ETM+ band 6H calibration data	uint8	2	Scan line count * 8 by 580 (row major)
17	L7sss1nYYDOYHHuuv.C70	SDS containing ETM+ band 7 calibration data	uint8	2	Scan line count * 16 by 1160 (row major)
18	L7sss2nYYDOYHHuuv.C80	SDS containing ETM+ band 8 calibration data	uint8	2	Scan line count * 32 by 2320 (row major)

Table 5.1 Level 0R SDSs

5.3.3 Vdata Definitions - Vdata structures are employed to store MSCD, PCD, the scan line offsets, and the geolocation information for the subinterval. All 0R Vdatas are designated full interlace which organizes the Vdata on a record by record basis. This mode allows additional records to be appended.

5.3.3.1 MSCD Vdata

Table 5.2 lists the contents of the MSCD Vdatas for either format 1 or 2. Table 5.3 lists the contents of the PCD Vdata for either formats 1 or 2. Table 5.4 lists the contents of either the format 1 or 2 scan offsets and table 5.5 lists the contents of the geolocation Vdata.

Vdata Name: L7sssfYnYYDOYHHuuv.MSD				
Vdata Class: LPS_MSCD				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 85				
Number of Records: One record per product scan line (major frame)				
Field Name	Number Type	Order	Description	Remarks
scan_no	uint16	1	Subinterval scan line counter values = 0 - 11725	Provides a sequence counter for the ETM+ scans (major frames) contained in a subinterval.
scan_time	float64	1	PCD major frame time in GMT integer and fractional seconds since January 1, 1993 (TBR)	Time code conversion from scan_timecode (see next entry)

Table 5.2. MSCD Vdata - format 1 or 2 (continued)

scan_timecode	char8	25	Scan line time of the format yyyy:ddd:hh:mm:ss.tttttt yyyy: four digit Julian year ddd: day (01 - 366) hh: hours (00-23) mm: minutes (00-59) ss: seconds (00-59_ tttttt: fractional seconds (0 - 9999375)	The ETM+ scan start time extracted from the timecode minor frames of the ETM+ major frame data reported in this data record. A computed scan start time is provided if a valid time is not available from the time code minor frames. Time expressed using the Greenwich Mean Time (GMT) standard.
timecode_flag	uint8	1	Valid timecode flag, where 0 = valid timecode, 1 = computed timecode	
eol_flag	uint8	1	Flag for valid end of line (EOL) pattern code: 0 = valid pattern in expected minor frame location 1 = flywheeled EOL - erroneous pattern in expected location 2 = valid pattern found outside the expected range	A flywheeled EOL (flag = 1) may indicate errors in the received major frame. A value of 2 may indicate errors in scan and/or calibration data line lengths (significantly more than or less than minor frames in the scan).
eol_location	uint16	1	Minor frame location (number in the range: 6318 - 6323 (TBR) The minor frame location (number) within a major frame that contains the first word of the ETM+ EOL code. the eol_flag reports eol_location errors.	The EOL is expected to occur within the vicinity of minor frame number 6320 in each ETM+ major frame. The EOL code consists of two adjacent minor frames. The EOL indicates an end of the active scan period and start of a calibration data period past the scan line data (SLD) words.
scan_dir_vote	uint8	1	Scan direction majority vote quality 0 = all bits in all scan direction word groups are equal. 1 = at least one bit in the scan direction word groups is not equal to the other bits 2 = scan direction not found for a missing and/or an entirely filled scan and is therefore interpolated from the previous scan.	A majority vote quality of 1 may indicate an error with the received and/or decoded scan direction value (back to back forward or reverse scans).
scan_dir	char8	1	Scan direction character 'F' = Forward Scan 'R' = Reverse Scan	The ETM+ scan direction is interpolated from SLD minor frames of the first valid ETM+ major frame. This scan direction is for the previous scan (major frame).
fhs_vote	uint8	1	FHS error majority vote quality 0 = all bits in each FHS error word group are equal 1 = at least one bit in at least one FHS error word group is not equal to the other bits in the group	A value of 1 indicates that the received/decoded fhs_err value is probably erroneous.
fhs_err	int16	1	First half scan error count: -2048 to 2047	The first half scan error is interpolated from the SLD minor frames of the ETM+ major frame. This value is for the previous scan.

Table 5.2. MSCD Vdata - format 1 or 2 (continued)

shs_vote	uint8	1	SHS error majority vote quality 0 = all bits in each SHS Error word group are equal 1 = at least one bit in at least one SHS error word group is not equal to the other bits in the group	A value of 1 indicates that the received/decoded shs_err value is probably in error.
shs_err	int16	1	Second half scan error count: -2048 to 2047	The second half scan error is interpolated from the SLD minor frames of the ETM+ major frame. This value is for the previous scan.
gain_status	char8	9	"ggggggggg" where g's identify bands 123456678 for both formats = 123456\$\$\$ for format 1 = \$\$\$\$\$\$678 for format 2 where \$ identifies unused fields g = L indicates a low gain state g = H indicates a high gain state	For each band, the gain status is defined by the gain state value in the "PCD/Status Data" field of the first error-free VCDU containing data for the scan.
gain_change	char8	9	"ggggggggg" where g's identify bands 123456678 for both formats = 123456\$\$\$ for format 1 = \$\$\$\$\$\$678 for format 2 g = 0 in a band position indicates no gain change since last scan g = + in a band position indicates a gain from low to high g = - in a band position indicates a gain change from high to low	This value is 0 if it's the first scan of a subinterval.
mux_assembly_id	uint8	1	= 0 - 7, for Landsat 7 multiplexer assemblies 0-7 (TBR)	Identifies the Landsat 7 spacecraft on-board multiplexer used in the ETM+ data flow for this major frame. The multiplexer status is obtained from the first error-free CADU/VCDU used in the construction of this major frame.
cal_shutter_status	uint8	1	0 = primary shutter 1 = backup shutter	Identifies the Landsat 7 spacecraft internal calibration shutter status during the ETM+ data flow for this major frame. The CAL shutter status is obtained from the first error-free CADU/VCDU used in the construction of this major frame.
cadu_sync	uint8	1	Flag to indicate loss of CADU sync anywhere within the scan 0 = no loss, 1 = sync loss	A sync loss condition indicates potential loss of minor frame data requiring LPS to use fill data in completing a major frame.

Table 5.2. MSCD Vdata - format 1 or 2 (continued)

scan_sync	uint8	1	Flag for valid sync for current major frame, 0 = valid sync, 1 = flywheeled sync	Valid sync = line sync code was correctly found and decoded as specified in the Landsat 7 DFCB. Flywheeled sync = the line sync code minor frame could not be correctly found and/or decoded as specified in the Landsat 7 DFCB. The presence of the line sync code was "deduced" from correctly finding/decoding the time code minor frames of an ETM+ major frame
minf_faults	char8	1	An index (hexadecimal 0 through D) representing the number of minor frame faults (m) in the range: N = 0 for no faulty minor frames N = 1 for 1 <= m <= 2 N = 2 for 3 <= m <= 4 N = 3 for 5 <= m <= 8 N = 4 for 9 <= m <= 16 N = 5 for 17 <= m <= 32 N = 6 for 33 <= m <= 64 N = 7 for 65 <= m <= 128 N = 8 for 129 <= m <= 256 N = 9 for 1257 <= m <= 512 N = A for 513 <= m <= 1024 N = B for 1025 <= m <= 2048 N = C for 2049 <= m <= 4096 N = D for 4097 <= m <= NNNN NNNN is an LPS operator selectable parameter for the maximum number of minor frames possible in an ETM+ major frame.	This quality index is computed by LPS on a major frame basis. This index provides a quick-look assessment on the number of faulty minor frames contained in a major frame. Faulty minor frames contain fill data or are extracted from VCDUs containing uncorrected BCH errors. Lower quality indices indicate better quality major frames. Without bumper wear, there is a nominal of 7,423 minor frames in an ETM+ major frame. Accounting for 17 (TBR) minor frames of bumper wear on each end of the scanner, there could be a maximum of 7,457 (TBR) minor frames in an ETM+ major frame.
cadus_vcdus_received	unit16	1	= 0 - 650 Approximately 643 VCDUs are required to build one ETM+ major frame (~7,423 minor frames).	The number of VCDUs used to construct this ETM+ major frame.
fly_wheel_cadus	unit16	1	= 0 - 650	The total number of flywheel CADUs/VCDUs in this ETM+ major frame.
bit_slip_cadus	unit16	1	= 0 - 650	The total number of CADUs/VCDUs detected with bit slip errors in this ETM+ major frame.
r-s_err_vcdus	unit16	1	= 0 - 650	The number of VCDUs with Reed-Solomon error used in building this ETM+ major frame.
bch_corrected_vcdus	unit16	1	= 0 - 650	The total number of VCDUs, containing corrected BCH errors, in this major frame
bch_uncorrected_vcdus	unit16	1	= 0 - 650	The total number of VCDUs containing uncorrected BCH errors in this major frame.

filled_scan_flag	uint8	1	0 = no fill data used in this scan 1 = entirely filled scan 2 = partially filled scan	This flag indicates if any predetermined fill data was used to build this ETM+ scan.
mint_filled	uint16	1	= 0 - 7500	The total number of filled minor frames in this ETM+ major frame. There are nominal 7,423 minor frames in a scan.

Table 5.2. MSCD Vdata - format 1 or 2

5.3.3.2 PCD Vdata

A PCD major frame is generated every 4.096 spacecraft seconds. Each record in the PCD Vdata represents a major frame. All data in Table 5.3 are presented in their respective engineering units. Additional details can be found in applicable document 4.1.2.

Vdata Name: L7sssfYDOYHHuuv.PCD				
Vdata Class: LPS_PCD				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 26,472				
Number of Records: One record per PCD major frame (4.096 spacecraft second)				
Field Name	Number Type	Count	Description	Remarks
cycle_count	uint8	1	PCD cycle number (00 - 99) There are approximately 52 PCD cycles in a 14 minute subinterval.	The PCD cycle number associated with PCD major frame reported in this record of the PCD file. A PCD cycle consists of a set of 4 consecutive PCD major frames: (0), (1), (2), and (3). This number is incremented by 1 for each PCD major frame.
majf_count	uint8	1	Major frame counter (001 - 255) The maximum number of PCD major frames in a 14 minute subinterval is 206.	The major frame counter value of the PCD major frame reported in this record of the subinterval PCD file. The PCD major frame number is incremented by one for each new PCD major frame added to this file.
majf_id	uint8	1	PCD major frame ID (0-3)	PCD major frame (0) is identified by the presence of spacecraft ID and timecode information. Other PCD major frames are identified by their ID numbers (1-3).
majf_time	float64	1	PCD major frame time in GMT integer and fractional seconds since January 1, 1993 (TBR)	This time is the PCD major frame time (majf_timecode; see next entry) converted by LPS to seconds since January 1, 1993.

Table 5.3. PCD Vdata - format 1 or 2 (continued)

Field Name	Number Type	Count	Description	Remarks
scan_timecode	char8	25	Scan line time of the form 'YYYY:ddd:hh:mm:ss.tttttt' YYYY: four digit Julian year ddd = Julian day (001 - 365) hh = hours (00-23) ss = seconds (00-59) tttttt: fraction seconds (0-9999375 or 0-15/16 milliseconds)	For PCD major frame (0), the spacecraft time is extracted from PCD major frame (0) of a PCD cycle. For PCD major frames 1-3, the spacecraft timecode is interpolated using the time received for PCD major frame (0) of the associated PCD cycle. Time expressed using the GMT standard.
mnfm_ids_000_127	uint8	128	Minor frame counter or ID: 000- 127	The PCD minor frame counter value/ID from word location 65 of each minor frame. There are 128 (IDs: 000–127) minor frames in a PCD major frame.
bands_state	char8	8	Indicates ETM+ bands on/off states for Format 1 and Format 2 data. = 12345678 for all bands "ON" state in Format 1 and Format 2 data. A "-" indicates an off state or a missing band (e.g., "123-56" means band 4 is off or missing).	
fac_flag	uint8	1	Full aperture calibration door flag: = 0 indicates no activity = 1 indicates activity (means door is open and is ready for or being images.	ETM+ calibration activity status. This status is interpolated from "serial word P" of the third PCD major frame, minor frame 83, word 72, bits 2 and 3.
PCD Major Frame Quality and Accounting Data				
unpacked_pcd_words	uint32	1	= 0–147,497 unpacked PCD words received for this major frame.	Count of unpacked PCD words received for this PCD major frame.
unpacked_words_missing	uint32	1	= 0–147,497 unpacked PCD words missing for this major frame.	Count of unpacked PCD words identified as missing due to missing VCDUs. Some received PCD major frames may contain LPS filled data.
vote_errors	uint16	1	= 0–16384 packed words in a PCD major frame.	Count of (packed) PCD major frame words found to contain voting errors during packing a PCD word/minor frame. Some PCD major frame words may contain erroneous or LPS filled data.
minf_sync_errors	uint8	1	= 0–128 (minor frames per major frame)	Count of PCD minor frames received with sync errors in this major frame. Some PCD words may be lost and filled due to minor frame sync errors.
minf_id_errors	uint8	1	= 0–128 (minor frames per major frame)	Count of PCD minor frames received with incorrect minor frame IDs (counter values). Corrected IDs are filled in.
minf_filled	uint8	1	= 0–128 (minor frames per major frame)	Count of PCD minor frames found with erroneous data in PCD words and filled by LPS with a known value.

Table 5.3. PCD Vdata - format 1 or 2 (continued)

Field Name	Number Type	Count	Description	Remarks
majf_flag	uint8	1	PCD major frame flag where 0 = valid major frame ID 1 = incorrect major frame ID; Used for major frames (1), (2), and (3) only. If in error, the PCD major frame ID is corrected by LPS.	Indicates the quality of the PCD major frame ID found in word 72, minor frames 96–103 of PCD major frames (1), (2), and (3). PCD major frame (0) contains the timecode flag (see below).
timecode_flag	uint8	1	Valid PCD timecode flag, where 0 = valid timecode and spacecraft ID 1 = computed timecode 2 = corrected spacecraft ID 3 = flags 1 and 2 combined.	Indicates the quality of the spacecraft ID and timecode data contained in word 72, minor frames 96–103, of PCD major frames(0). For PCD major frames (1)– (3), the timecode flag is also interpolated /derived from the timecode flag used for major frame (0).
PCD Major Frame clock, temperature, ephemeris, and attitude data				
spacecraft_ID	char8	1	spacecraft_ID = "7"	The Landsat 7 spacecraft ID is determined from bytes 0–3 of PCD timecode word 96 located in major frame (0) of each PCD cycle. For the remaining three major frames in a PCD cycle, this spacecraft ID is copied for each major frame. The spacecraft ID is also forced to "7" when an erroneous ID is read. The spacecraft ID error is noted in the s/c_id_pcd field.
<p>The following four parameters are used to correct the spacecraft time, reported in the PCD and video, for clock drift to within 15 milliseconds of UTC using the following formulas.</p> $\Delta t = T_{sc} - sv_clk_last_ud_time$ $T_c = T_{sc} + C_0 + C_1 \Delta t + .5 C_2 (\Delta t \Delta t)$ <p>where T_c is the correct time, T_{sc} is the uncorrected time, Δt is the spacecraft clock time relative to the last update.</p>				
sv_clk_last_ud_time	float64	1	sv_clk_last_ud_time = 0–31,622,400 seconds from midnight of the first day of the current year.	The time of the last space vehicle clock update is inserted in the PCD stream by the MOC once per day during ETM+ non-image periods.
time_drift_bias_c0	int16	1	Spacecraft time drift bias (C_0) = -15 to +15 milliseconds	Clock correction bias term - can be used to minimize the clock error over some span of time; may be set to zero if not needed.
time_drift_rate_c1	int16	1	Spacecraft clock drift rate (C_1) = +/- TBD milliseconds/day	Clock correction first order coefficient (drift rate)
time_drift_acceln_c2	int16	1	Spacecraft clock drift acceleration (C_2) = +/- TBD milliseconds/day ²	Clock correction second order coefficient (drift acceleration); may be set to zero if not needed.
ETM+ Telemetry sampled @4.096 seconds Rate				
The following ETM+ telemetry is sampled every 4.096 seconds and inserted into the next PCD major frame. Major frames with missing or erroneous values are filled with ones (FF in hexadecimal).				
black_body_temp_is o	uint8	1	Black Body Temperature (Isolated)	
cfpa_heater_current	uint8	1	CFPA Heater Current	
cal_shutr_flag_temp	uint8	1	Calibration Shutter Flag Temperature	
bu_shutr_flag temp	uint8	1	Backup Shutter Flag Temperature	

Table 5.3. PCD Vdata - format 1 or 2 (continued)

Field Name	Number Type	Count	Description	Remarks												
black_body_temp_con	uint8	1	Black Body Temperature (Control)													
baffle_temp_heater	uint8	1	Baffle Temperature (Heater)													
cfpa_control_temp	uint8	1	CFPA Control Temperature													
pdf_ad_ground_ref	uint16	1	PDF A/D Ground Reference													
ETM+ Telemetry sampled @16.384 seconds Rate																
The following PCD values are repeated for each PCD major frame. Major frame with missing or erroneous values are filled with ones (FF in hexadecimal).The following PCD values should be copied in the same format as found in their respective PCD words/minor frames in a PCD major frame.																
serial_word_a_s	uint8	18	a,b,c,d,e,f,g,h,i,j,k,l,m,n,p,q,r,s	<table><tr><th>Serial Word "D"</th><th>Bits</th></tr><tr><td>IC Lamp 1 ON</td><td>0</td></tr><tr><td>IC Lamp 2 ON</td><td>1</td></tr><tr><td>Spares</td><td>2,5,6,7</td></tr><tr><td>IC Lamp 1 Backup ON</td><td>3</td></tr><tr><td>IC Lamp 2 Backup ON</td><td>4</td></tr></table>	Serial Word "D"	Bits	IC Lamp 1 ON	0	IC Lamp 2 ON	1	Spares	2,5,6,7	IC Lamp 1 Backup ON	3	IC Lamp 2 Backup ON	4
Serial Word "D"	Bits															
IC Lamp 1 ON	0															
IC Lamp 2 ON	1															
Spares	2,5,6,7															
IC Lamp 1 Backup ON	3															
IC Lamp 2 Backup ON	4															
mux1_elec_temp	uint8	1	Mux 1 Electronics Temperature	See above												
mux1_ps_temp	uint8	1	Mux 1 Power Supply Temperature	See above												
mux2_elec_temp	uint8	1	Mux 2 Electronics Temperature	See above												
mux2_ps_temp	uint8	1	Mux 2 Power Supply Temperature	See above												
acs_cpu_mode	uint8	1	ACS CPU Mode	See above												
etm_tlm_mnf_16_30	uint8	15	ETM TLM MF(2), mfs(16–30)	See above												
etm_tlm_mnf_40_49	uint8	10	ETM TLM MF(2) mfs(40–49)	See above												
etm_on_time	float64	1	Time ETM+ was last on: etm_on_time = 0–31,622,400 seconds from midnight of the first day of the current year. Reported for each PCD major frame (0) record. If a PCD major frame (1, 2, or 3) does not contain the required PCD value, use all ones as the fill value.	See L7 DFCB Sections 3.2.7.4.6 and 3.2.7.4.16 for details on this time. Reported as an HDF double precision floating point number to accommodate the 48-bit extended precision floating point value/sample received in major frame (0) of a PCD cycle.												
etm_off_time	float64	1	Time ETM+ was last off: See above for related description.	See above												
Ephemeris Data																
The ephemeris data, consisting of the position and velocity components, is available on a PCD major frame basis. See L7 DFCB, Vol 4, Section 3.2.7.4.8 for additional details.																
Note: The ephemeris data source minor frame locations change for odd and even numbered major frames (0–3).																
ephem_position_xyz	float32	3	x,y,z position range: +/- 8.3886 x 10 ⁶ meters	See above												
ephem_velocity_xyz	float32	3	x,y,z velocity range: +/- 8.0 meters/milliseconds	See above												
Attitude Estimate																
See Landsat 7 DFCB, Vol 4, Section 3.2.7.4.5 for word/minor frame locations of attitude data in PCD major frames.																
atitude_est_epa1234	float32	4	epa1, epa2, epa3, epa4 Attitude Euler parameter	Same as above												

Table 5.3. PCD Vdata - format 1 or 2 (continued)

Field Name	Number Type	Count	Description	Remarks
Gyro (IMU Axes) Data Note: The following IMU axes (x, y, z) readings are repeated 64 times in each major frame. The IMU axes values are in arc-seconds of angular motion. A total of 256 readings (samples) are collected for each PCD cycle. The Gyro data order is as follows: - all 64 roll values (Roll-1, Roll-1...) - all 64 pitch values (Pitch-1, Pitch-2...) - all 64 yaw values (Yaw-1, Yaw-2...) See L7 DFCB, Vol. 4, Section 3.2.7.4.3 for additional details. Each IMU axes counter value is first constructed by concatenating the three bytes for each axis (e.g., x1, x2, x3) and then converting to arc-seconds. For converting the IMU counter values to engineering units, each increment or decrement in the 24-bit counter value of an IMU axes represent a 0.061 arc-second change.				
Gyro-select_data	char8	1	= "A" for gyro A selected, or = "B" for gyro B selected, or = "-" to indicate a gyro select error (decoding error). A gyro selection is error free when all three X, Y, and Z axes associated with a selected gyro, A or B, are true (1s for gyro A and 0s for gyro B).	Bits 0-2 of minor frame 34 in subcom word 72 of PCD major frame 0 identifies the Landsat 7 selected gyro, A or B. Bits 3-7 are ignored.
imu_roll_x00_x63	float64	64	Where imu_x_roll_nn = - 511705.088 to + 511705.027 arc-seconds, and; nn = 0-63 represents the sample number within the major frame.	See above
imu_roll_y00_y63	float64	64	See above	See above
imu_roll_z00_z63	float64	64	See above	See above
Gyro Drift Data Note: The gyro drift data is reported once per PCD cycle in major frame (0) only. See L7 DFCB, Vol. 4, Section 3.2.7.4.4 for additional details.				
theta_theta_xyz	float64	3	x, y, z gyro drift The units of gyro drift (rate) data for each axis are in radians/512 milliseconds.	The least significant bit weight of the theta value is adjusted to 2^{-47} before converting to engineering units.
Angular Displacement Sensor Data (ADS) Note: The minor frame IDs are reported serially for each major frame. The 16 sets of ADS x, y, z values are reported as a distinct entry for each of the 128 minor frames in a PCD major frame. All ADS x, y, z measurements are converted to microradians and reported in ascending order of their source words and minor frames in a PCD major frame. All data is reported with single floating point precision. See L7 DFCB, Vol. 4, Section 3.2.7.4.1 additional details. A total of 16 ADS measurements, each consisting of the x,y and z components, are received in a PCD minor frame.				
ads_xyz16_mnfm_000	float32	48	ads measurement x01, y01, z01 through x16,y16,z16 received in minor frame 0	
ads_xyz16_mnfm_001	float32	48	ads measurement x01, y01, z01 through x16,y16,z16 received in minor frame 1	

Field Name	Number Type	Count	Description	Remarks
• • •	• • •	• • •	ads measurements as above for minor frames 2 through 127	
ads_xyz16_mnfm_127	float32	48	ads measurement x01, y01, z01 through x16,y16,z16 received in minor frame 128	
ADS Temperatures Note: The ADS x, y, z, and A/D electronic temperature values are reported on a major frame basis. All temperatures are reported in degrees Centigrade. See L7 DFCB Vol 4, Section 3.2.7.4.2 for additional details.				
ads_temp_xyz+ad	float32	4	See above	See above
PCD Quality and Accounting Data The following PCD quality data is LPS-produced and appended to each major frame record of the PCD file.				
sc_id_err_pcd	char8	1	Spacecraft ID error in PCD: sc_id_err_pcd = "n" for no errors "y" for errors detected in the spacecraft ID field	The error flag is true whenever the spacecraft ID is not equal to "7" and is corrected to "7".
att_data_quality	char8	1	Attitude Data Point Quality: att_data_quality = "g" for a good data "r" for rejected data "m" for missing data	Determined and produced by LPS for each PCD major frame. "V" indicates that the attitude data failed range check. "m" indicates missing attitude data replaced with fill data.
ephem_data_quality	char8	1	Ephemeris Data Point Quality: ephem_data_quality = "g" for a good data "r" for rejected data "m" for missing data	Determined and produced by LPS for each PCD major frame. "V" indicates ephemeris data failed range check. "m" indicates missing ephemeris data replaced with fill data.

Table 5.3 PCD Vdata - format 1 and 2

5.3.3.3 Scan Line Offsets Vdata

The scan line offset tables provide the amount of zero fill before and after actual scene and calibration data on a data line by data line basis. Offsets result from the detector arrangement on the two focal planes, a scan line length that can vary from nominal, and the decision to include all data in the OR product. There is one scan line offset Vdata per product band or band segment (i.e. band 8). The number of Vdata records or entries is equal to the number of data lines in the corresponding band or band segment file.

Two external elements or files, one for each format, are used to store the scan line offset Vdatas. They are ordered or stacked in a band sequential format which means all band 1 records are followed by band 2, followed by band 3 and so on. Multi-segment band 8 Vdatas are sequentially ordered by ascending data line number.

As with other product tables, the scan line offset Vdatas follow similar naming conventions. However, the extensions vary so to associate each Vdata with its particular band. The scan line offset names are as follows:

Format 1

Band 1 - L7sssfYDDOYHHuuv.O10
 Band 2 - L7sssfYDDOYHHuuv.O20
 Band 3 - L7sssfYDDOYHHuuv.O30
 Band 4 - L7sssfYDDOYHHuuv.O40
 Band 5 - L7sssfYDDOYHHuuv.O50
 Band 6 - L7sssfYDDOYHHuuv.O60

Format 2

Band 6 - L7sssfYDDOYHHuuv.O60
 Band 7 - L7sssfYDDOYHHuuv.O70
 Band 8 - L7sssfYDDOYHHuuv.O80

Table 5.4 lists the contents of either the format 1 or 2 scan line offsets.

Vdata Name: L7sssfYDDOYHHuuv.ONN				
Vdata Class: LPS_SLO				
Interlace Type: FULL_INTERLACE				
Bytes Per Logical Record: 44				
Number of Records: One record per data line for the corresponding band file.				
Field Name	Number Type	Count	Description	Remarks
scan_timecode	char8	25	Scan line time of the form 'YYYY:ddd:hh:mm:ss.tttttt' where YYYY: Four-digit Julian year ddd: Day (01 through 366) hh: hours (00 through 23) mm: minutes (00 through 59) ss: seconds (00 through 59) tttttt: fractional seconds (0-9999375 or 0-15/16 milliseconds)	The ETM+ scan start time extracted from the timecode minor frames of the ETM+ major frame data reported in this record. A computed scan start time is provided if a valid time is not available from the ETM+ time code minor frames. The scan time code is referenced to GMT.
scan_time	float64	1	The ETM+ scan time in decimal notation seconds since midnight on January 1, 1993, rounded to 7 decimal places.	The scan_time is obtained by converting the scan_timecode (last entry) to seconds. This is also referenced to GMT.
scan_no	uint16	1	scan_no = 1-11,725 The maximum scan count is based on a subinterval duration of 14 minutes for 35 scenes, each consisting of 335 scans.	A sequence counter for ETM+ scans (major frames) contained in a subinterval. The ETM+ scan counter is incremented by one for each new scan, real or flywheeled, added to the subinterval file.
scan_data_line_no	uint32	1	scan_data_line_no = SSSSSS where SSSSSS = 1-187,600 for Bands 1-5 and 7 = 1-93,800 for Band 6 = 1-375,200 for Band 8 Note: The Band 8 scan data line count is not reset between segments (1-3).	The scan line counter is incremented for each detector data line added to the product band file. There are 16 scan data lines each for bands 1-5 and 7, 8 for band 6, and 32 for band 8 in each ETM+ scan. The maximum line counts are shown for a 14-minute subinterval (35 scenes).

detector_id	int8	1	where the detector_id is in the range: = 1–16 for Bands 1–5 and 7 = 1–8 detectors for Band 6 = 1–32 for Band 8	Each scan line in an image file consists of samples from a single detector of a single band. Each detector, chosen in an descending ID order, is used once during each scan for generating a scan line.
scan_data_line_offset_rhs	int16	1	= 0–240 bytes for Bands 1–5 and 7 = 0–120 bytes for Band 6 (Format 1) and 6H (Format 2) = 0–480 bytes for Band 8 The scan line data may be shifted to right in the band data buffer after an integer-pixel alignment.	The scan line data is shifted to the right in a larger buffer to accomodate integer pixel alignment without data loss. After integer-pixel alignment, this field indicates the trailing zero fill buffer for each data line. This offset can accommodate an enlarged active scan line length from attitudinal gyrations and ETM+ bumper wear.
scan_data_line_offset_lhs	int16	1	= 0–44 bytes for Bands 1–5 and 7 = 0–22 for Band 6 = 0–88 for Band 8	Note: The left-hand-side offset is not as significant as the right-hand-side margin. It can accommodate scan line length growths due to ETM+ scanner bumper wear.

Table 5.4 Scan Line Offsets Vdata

5.3.3.4 Geolocation Index Vdata

Table 5.5 lists the contents of the geolocation index Vdata.

Vdata Name: L7sssfYDDOYHHuuv.GEO			
Vdata Class: Index			
Interlace Type: FULL INTERLACE			
Bytes Per Logical Record: 57			
Number of Records: One record per WRS scene in the product			
Field Name	Number Type	Count	Description
UilLon	float32	1	scene longitude - upper left corner
UilLat	float32	1	scene latitude - upper left corner
UrilLon	float32	1	scene longitude - upper right corner
UrilLat	float32	1	scene latitude - upper right corner
LilLon	float32	1	scene longitude - lower left corner
LilLat	float32	1	scene latitude - lower left corner
LrilLon	float32	1	scene longitude - lower right corner
LrilLat	float32	1	scene latitude - lower right corner
FirstLine_15m	float32	1	beginning scene line number - 15m
LastLine_15m	float32	1	ending scene data line number - 15m
FirstLine_30m	float32	1	beginning scene line number - 30m
LastLine_30m	float32	1	ending scene line number - 30 m
FirstLine_60m	float32	1	beginning scene line number - 60m
LastLine_60m	float32	1	ending scene line number - 60 m
FullScene	char8	1	full scene indicator flag (Y or N)

Table 5.5 Geolocation Index Vdata

5.3.4 Attribute Definitions - Metadata

Three metadata attribute files accompany a 0R product. They are structured using the ODL syntax as ASCII text blocks. Two of the files are created by LPS and describe the subinterval used to create a product. The third file is created by ECS and describes the contents of the product actually ordered.

5.3.4.1 LPS Metadata

The two LPS metadata files describe format 1 and format 2. They contain metadata for the subinterval as well as individual scenes. The subinterval metadata contains reference information on the raw wideband data source (e.g., an LGS X-band channel), the LPS resources (equipment strings) used in Level 0R processing, and identification information on the Level 0R data files produced for the archive. The scene metadata provides details on each WRS scene identified in a subinterval during level 0R processing. Each scene is a logically separated metadata group containing identification information such as scene center and corner coordinates, cloud cover scores, and quality and accounting information on the image data and PCD associated with the scene. Up to 35 scene groups may occur for a 14-minute maximum Landsat 7 contact period.

The LPS metadata file for both formats is defined in Table 5.6. The format 1 file contains subinterval and scene metadata for bands 1–6. Likewise, format 2 file contains subinterval and scene metadata for bands 6–8. The browse file names and the cloud cover scores are provided in the format 1 metadata file only. The two LPS files undergo no content change during 0R product generation but are transformed from encapsulated HDF files to external elements. Their HDF addresses and offsets are placed in the HDF directory file common to all product components.

Table 5.6: LPS Metadata File Contents - ODL Parameter Values

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description / Remarks
GROUP	22	= METADATA_FILE	Beginning of the first level ODL group. It indicates the start of the LPS Metadata File Level Group records for an ETM+ Format 1 or Format 2 subinterval.
GROUP	27	= METADATA_FILE_INFO	Beginning of the second level ODL group. It indicates the start of the LPS Metadata File information Group records.
FILE_NAME	22	= L7XsssfnYYDOYHHuuv.xxx where xxx = "MTA" for the metadata file.	Complete details on the LPS file naming convention are specified in Section 3.4.

FILE_CREATION_DATE_TIME	20	<p>= YYYY-MM-DDThh:mm:ssZ where</p> <p>YYYY = four-digit Julian year (e.g., 1998 and 2001)</p> <p>MM = month number of a Julian year (01–12 for January to December)</p> <p>DD = day of a Julian month (01–31)</p> <p>T indicates the start of time information in the ODL time code format</p> <p>hh = hours (00–23)</p> <p>mm = minutes (00–59)</p> <p>ss = seconds (00–59)</p> <p>Z indicates "Zulu" time (same as GMT)</p>	<p>The LPS system date and time when the metadata file for a Level 0R file set was created. For ease of human readability, this date and time information is presented in the ODL ASCII format. The time is expressed as Universal Coordinated Time (also known as Greenwich Mean Time (GMT)).</p> <p>Insertion of additional characters "T" and "Z" is required to meet the ODL ASCII time format.</p>
FILE_VERSION_NO	1	<p>= 0–9 where:</p> <p>FILE_VERSION_NO = 0 indicates "not a reprocessed file"</p> <p>FILE_VERSION_NO = 1–9 indicates the file reprocess count.</p> <p>The one_digit LPS file version number is also used in the FILE_NAME</p>	<p>Reprocessing indicator to distinguish this file from the metadata file generated earlier for the same subinterval and provided to the EDC-DAAC. The reprocessing information is entered/supplied by an operator during setup of the Level 0R processing operations.</p>
STATION_ID	3	<p>= SSS where</p> <p>SSS indicates a three character ground station code. For LPS, SSS = "EDC"</p>	<p>This parameter identifies the Landsat 7 ground station that produced the metadata and its associated Level 0R files.</p> <p>This parameter is used to distinguish the metadata and its associated Level 0R files that may be produced by the U.S. (e.g., EDC) and non-U.S. (e.g., GNC of Canada) ground stations using the same raw wideband data (with the same contact period start time).</p>
SOFTWARE_VERSION_NO	5	<p>= NNNNN where</p> <p>NNNNN is an alphanumeric string with an open format to indicate LPS software release, version, and test level, etc. Actual format will be determined by LPS during software development and by EDC during the operations phase.</p>	<p>Version number of the software installed on the LPS string when a metadata and its associated Level 0R files were generated.</p>
L7_CAL_PARAM_FILE_VERSION_NO	1–4	= 1–9999	<p>The version number of the Landsat 7 Calibration Parameter file received from IAS and used in generating the Level 0R files identified in this metadata file.</p>
END_GROUP	27	= METADATA_FILE_INFO	<p>End of the second level ODL group. It indicates the end of the LPS Metadata File information Group records.</p>

GROUP	29	= SUBINTERVAL_METADATA_FMT_m where m = 1 for Format 1 OR m = 2 for Format 2	Beginning of the second level ODL group. It indicates the start of the ETM+ Format 1 or Format 2 subinterval level Metadata group records.
SPACECRAFT_ID	8	= "Landsat7"	
SENSOR_ID	4	= "ETM+"	
CONTACT_PERIOD_START_TIME	17	YYYY:DOY:HH:MM:SS where YYYY = four-digit Julian year DOY = Julian day of year (001–366) HH = hour of day (00–23) MM = minutes (00–59) SS = seconds (00–59)	The Julian date and GMT when the capture of a Landsat 7 contact period, associated with this subinterval, was started by the LPS. An uppercase time format indicates time obtained from LPS or a Landsat 7 system. A lowercase time format indicates time obtained from the Landsat 7 spacecraft wideband data (image and/or PCD).
CONTACT_PERIOD_STOP_TIME	17	YYYY:DOY:HH:MM:SS (See above: CONTACT_PERIOD_START_TIME)	The Julian date and GMT when capture of a contact period, associated with this subinterval, was completed by the LPS.
WRS_PATH	3	= 001–233 (leading 0s are required)	The WRS path number for the scenes included in this subinterval.
STARTING_ROW	3	= 001–248 (leading 0s are required)	The starting WRS row number for the scene data included in this subinterval.
ENDING_ROW	3	= 001–248 (leading 0s are required)	The ending WRS row number for the scene data included in this subinterval.
SUBINTERVAL_START_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where YYYY = four-digit Julian year ddd = day (001–366*) hh = hours (00–23) mm = minutes (00–59) ss = seconds (00–59) tttttt = fractional seconds (0–9999375 or 0–15/16 milliseconds) * For cases when active imaging occurs past the end of a leap year during a single contact period.	The spacecraft time extracted from the timecode minor frames of the first ETM+ major frame of the subinterval reported in this file. A computed start time is provided if the timecode in the first ETM+ major frame is in error. Note: The year information (Capitalized) is appended by LPS to the spacecraft timecode.
SUBINTERVAL_STOP_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	The spacecraft time extracted from the timecode minor frames of the last ETM+ major frame of the subinterval reported in this file. Note: The year information (Capitalized) is appended by LPS to the spacecraft timecode.

TOTAL_ETM+_SCANS	1-5	= N-11725 where N is an LPS operator selectable parameter value for the smallest scene size to be included in a subinterval. The default value of N is 335.	The total number of ETM+ scans reported in this subinterval file. A maximum of 11,725 scans can be received in a 14-minute subinterval (based on a maximum of 35 scenes, each consisting of at most 335 scans)
PCD_START_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	Spacecraft time of the first PCD major frame in the PCD file associated with this subinterval.
PCD_STOP_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	Spacecraft time of the last PCD major frame in the PCD file associated with this subinterval.
TOTAL_PCD_MAJOR_ FRAMES	1-3	= 0-255	The total number of PCD major frames received in the PCD file associated with this subinterval. Approximately 212 major frames can be received by the LPS during a 14-minute subinterval.
SUBINTERVAL_UL_CORNER_ LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	LPS calculated "actual" latitude value for the upper left corner of the subinterval. A subinterval may start at the first actual scan (not filled) in a partial scene.
SUBINTERVAL_UL_CORNER_ LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	LPS calculated "actual" longitude value for the upper left corner of the subinterval. A subinterval may start at the first actual scan (not filled) in a partial scene.
SUBINTERVAL_UR_CORNER_ LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	LPS calculated "actual" latitude value for the upper right corner of the subinterval. A subinterval may start at the first actual scan (not filled) in a partial scene.
SUBINTERVAL_UR_CORNER_ LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	LPS calculated "actual" longitude value for the upper right corner of the subinterval. A subinterval may start at the first actual scan (not filled) in a partial scene.
SUBINTERVAL_LL_CORNER_ LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	LPS calculated "actual" latitude value for the lower left corner of the subinterval. A subinterval may end at the last actual scan (not filled) in a partial scene.

SUBINTERVAL_LL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	LPS calculated "actual" longitude value for the lower left corner of the subinterval. A subinterval may end at the last actual scan (not filled) in a partial scene.
SUBINTERVAL_LR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	LPS calculated "actual" latitude value for the lower right corner of the subinterval. A subinterval may end at the last actual scan (not filled) in a partial scene.
SUBINTERVAL_LR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	LPS calculated "actual" longitude value for the lower right corner of the subinterval. A subinterval may end at the last actual scan (not filled) in a partial scene.
ETM+_LAST_ON_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	See the Landsat 7 DFCB for details on this time.
ETM+_LAST_OFF_TIME	25	= YYYY:ddd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	See description, above, for ETM+_LAST_ON_TIME.
UT1_CORRECTION	8	= -0.90000—+0.90000 seconds This time could be as large as 0.9 seconds in increments of fractions of seconds.	The UTC-UT1 time difference in seconds obtained from the Landsat 7 Calibration Parameter file received from IAS.
BAND1_PRESENT	1	= "Y" indicates that Band 1 is present in this subinterval OR = "N" indicates that Band 1 is not present in this subinterval This field is included in the ETM+ Format 1 metadata only.	This is the "Band 1 ON" state information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 0, where a bit set condition. (=1) indicates "Band 1 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND2_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 1 metadata only.	This is the "Band 2 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 1, where a bit set condition (=1) indicates "Band 2 ON state." The first error-free PCD major frame (2) is used to derive this value.

BAND3_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 1 metadata only.	This is the "Band 3 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 2, where a bit set condition (=1) indicates "Band 3 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND4_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 1 metadata only.	This is the "Band 4 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 3, where a bit set condition (=1) indicates "Band 4 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND5_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 1 metadata only.	This is the "Band 5 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 4, where a bit set condition (=1) indicates "Band 5 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND6_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 1 or Format 2 metadata.	This is the "Band 6/MIR ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 5, where a bit set condition (=1) indicates "Band 6 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND7_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 2 metadata only.	This is the "Band 7 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 6, where a bit set condition (=1) indicates "Band 7 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.
BAND8_PRESENT	1	(Same as BAND1_PRESENT values and format). This field is included in the ETM+ Format 2 metadata only.	This is the "Band 8 ON" status information obtained from PCD Serial Word "E" (major frame (2), minor frame 35, word 72), bit 0, where a bit set condition (=1) indicates "Band 8 ON state." The first error-free PCD major frame (2), found in the subinterval, is used to derive this value.

TOTAL_WRS_SCENES	1–2	<p>= 0–99</p> <p>This field is included in ETM+ Format 1 metadata only.</p> <p>Note The LPS produces this count from the total number of WRS scenes identified in a subinterval. The LPS does not use the absolute difference between STARTING_ROW and ENDING_ROW to compute this +1 count.</p>	This count indicates the total number of WRS scenes identified by LPS in a subinterval. A maximum of 35 WRS scenes, including partial scenes at the start and/or the end of a subinterval, may be received by LPS in a 14-minute subinterval. This count also indicates the total number of multiband-scene browse files, for full and partial scenes, that may be produced by LPS and reported in the scene metadata.
PARTIAL_WRS_SCENES	1	= 0–2	Indicates the count of partial scenes, if any, at the start and/or at the end of a subinterval.
TOTAL_FILES	1–2	<p>= 10–45 (Format 1 with up to 35 multiband browse scene files) OR = 6 - 9 (Format 2 with up to 3 Band 8 file segments)</p>	The total number of LPS files included in this subinterval for ETM+ Format 1 or Format 2. Assuming that a subinterval contains at least one scene, the metadata file will contain the names of a minimum of 10 files (6 Band, 1 MSCD, 1 PCD, 1 Calibration and 1 Multiband-scene Browse Files) for Format 1, and 6 files (3 band, 1 MSCD, 1 PCD, and 1 Calibration files) for Format 2, respectively. A maximum of 35 multiband scene browse files are provided for Format 1 subinterval only.
BAND1_FILE_NAME	22	<p>= L7XsssfYDDOYHHuuv.xxx</p> <p>(See Section 5.3.2 for details on the file naming convention.)</p> <p>For the Band 1 file name: xxx = B10 (Format 1 only)</p>	This file name is included in a Format 1 metadata file only.
BAND2_FILE_NAME	22	<p>= L7XsssfYDDOYHHuuv.xxx</p> <p>(See Section 5.3.2 for details)</p> <p>For the Band 2 file name: xxx = B20 (Format 1 only)</p>	This file name is included in a Format 1 metadata file only.
BAND3_FILE_NAME	22	<p>= L7XsssfYDDOYHHuuv.xxx</p> <p>(See Section 5.3.2 for details)</p> <p>For the Band 3 file name: xxx = B30 (Format 1 only)</p>	This file name is included in a Format 1 metadata file only.
BAND4_FILE_NAME	22	<p>= L7XsssfYDDOYHHuuv.xxx</p> <p>(See Section 5.3.2 for details)</p> <p>For the Band 4 file name: xxx = B40 (Format 1 only)</p>	This file name is included in a Format 1 metadata file only.

BAND5_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 5 file name: xxx = B50 (Format 1 only)	This file name is included in a Format 1 metadata file only.
BAND6_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 6 file name: xxx = B60 (Format 1 or Format 2)	This file name is included in a Format 1 or Format 2 metadata file.
BAND7_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 7 file name: xxx = B70 (Format 2 only)	This file name is included in a Format 2 metadata file only.
BAND8_FILE_1_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 8, Segment 1 file name: xxx = B81 (Format 2 only)	This Band 8 file segment name is included in a Format 2 metadata file only. Up to three Band 8 file segments, each up to 2 GB long, are expected in a Format 2 subinterval.
BAND8_FILE_2_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 8, Segment 2 file name: xxx = B82 (Format 2 only)	The name of this Band 8 file segment, if it exists in a subinterval, is included in a Format 2 metadata file only.
BAND8_FILE_3_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) For the Band 8, Segment 3 file name: xxx = B83 (Format 2 only)	The name of this Band 8 file segment, if it exists in a subinterval, is included in a Format 2 metadata file only.
MSCD_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2 for details) xxx = MSD for an MSCD file	Name of the Mirror Scan Correction Data (MSCD) file associated with this subinterval.
PCD_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2) xxx = PCD for a PCD file	Name of the Payload Correction Data (PCD) file associated with this subinterval.
CAL_FILE_NAME	22	= L7XsssfYDDOYHHuuv.xxx (See Section 5.3.2) xxx = CAL for a Calibration file	Name of the Calibration file associated with this subinterval.
Scene Level Metadata (not an LPS metadata parameter)			The following parameters values are repeated for each ETM+ Format 1 or Format 2 scenes included in a subinterval.

GROUP	26	= SCENE_NN_METADATA where NN = 01–99 (Up to 35 scenes are expected in a 14-minute subinterval)	Beginning of the second level ODL group. It indicates the beginning of the ETM+ Format 1 or Format 2 Scene NN level Metadata group records.
GROUP	21	= WRS_SCENE_NN_METADATA where NN = 01–99	Beginning of the third level ODL group. It indicates the beginning of the ETM+ Format 1 or Format 2 WRS Scene 1 Metadata group records.
Scene Level Metadata (not an LPS metadata parameter)			The following parameters values are repeated for each WRS scene included in the subinterval.
WRS_SCENE_NO	1–2	= 1–99	This is the LPS assigned WRS scene number within a subinterval.
FULL_OR_PARTIAL_SCENE	1	= "F" or "P" where F indicates a full WRS scene OR P indicates a partial WRS scene at the start or end of a subinterval.	The LPS may receive partial WRS scenes at the start and/or the end of a subinterval.
BROWSE_FILE_NAME	22	= L7XssfnYYDOYHHuuv.xxx for a Format 1 subinterval (See Section 5.3.2) OR No browse file names are provided if its a Format 2 subinterval. xxx = Rnn where R indicates a Multiband Scene Browse file, and nn = 00–99 indicates the Multiband Scene Browse file number within a subinterval.	The LPS generates Multiband Scene Browse files for ETM+ Format 1 (Bands 1–6) only. The names of all Multiband Scene Browse files, generated for a Format 1 subinterval, are provided with and reported in the Format 1 metadata. A maximum of 35 WRS scenes are possible in a subinterval.
WRS_PATH	3	= 001–233 (leading zeros are required)	The WRS path number associated with the scene from PCD scene accounting.
WRS_ROW	3	= 001–248 (leading zeros are required)	The WRS row number associated with the scene
SCENE_CENTER_SCAN_NO	2–5	= 1–11725 (for "actual" scene centers in the subinterval. For a partial scene with less than a half scene length data, the scene center scan number may be outside the actual subinterval band data range. It will be pointed to the non-existent scan 0 in the band file.	The ETM+ scan number nearest the calculated (actual) center of a WRS scene. A WRS scene scan number within a 14-minute subinterval can be as high as 11,725.
SCENE_CENTER_SCAN_TIME	25	= YYYY:dd:hh:mm:ss.tttttt where the time format is the same as for SUBINTERVAL_START_TIME, above.	The spacecraft time associated with a WRS scene center scan (number).

SCENE_CENTER_LAT	8	<p>= -90.0000 through +90.0000 degrees (with a 4-digit precision)</p> <p>A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.</p>	<p>WRS Scene Center Latitude - LPS calculated coordinate value. The computed "actual" scene centers for full and greater than half a scene length partial scenes are expected to be in the proximity of the nominal WRS scene centers. They are always indexed to actual data in the band file. The computed "actual" scene centers for smaller than half a scene length partial scenes are also expected to be in the proximity of the nominal WRS scene centers, but outside the actual subinterval band data range. They are indexed to a non-existent scan 0 in the band file.</p>
SCENE_CENTER_LON	9	<p>= -180.0000 through +180.0000 degrees (with a 4-digit precision)</p> <p>A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.</p>	<p>WRS Scene Center Longitude - LPS calculated coordinate value. The computed "actual" scene centers for full and greater than half a scene length partial scenes are expected to be in the proximity of the nominal WRS scene centers. They are always indexed to actual data in the band file. The computed "actual" scene centers for less than half a scene length partial scenes are also expected to be in the proximity of the nominal WRS scene centers, but outside the actual subinterval band data range. They are indexed to a non-existent scan 0 in the band file.</p>
HORIZONTAL_DISPLAY_SHIFT	2-5	<p>= - 9999 through + 9999 meters</p> <p>A negative (-) value defines a shift of the calculated "true" WRS scene center to the West of the nominal WRS scene center.</p> <p>A positive (+) value defines a shift of the calculated "true" WRS scene center to the EAST of the nominal WRS scene center.</p>	<p>The horizontal distance between the perpendiculars through the LPS calculated "true" WRS Scene Center and the nominal (known) WRS scene center on ground. The LPS will maintain a lookup table of nominal WRS scene centers for computing the HORIZONTAL_DISPLAY_SHIFT (HDS) values for WRS scenes.</p>
SCENE_UL_CORNER_LAT	8	<p>= -90.0000 through +90.0000 degrees (with a 4-digit precision)</p> <p>A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.</p>	<p>WRS scene upper left corner "actual" latitude for a full or a partial scene.</p>

SCENE_UL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	WRS scene upper left corner "actual" longitude for a full or a partial scene.
SCENE_UR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	WRS scene upper right corner "actual" latitude for a full or a partial scene.
SCENE_UR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	WRS scene upper right corner "actual" longitude for a full or a partial scene.
SCENE_LL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	WRS scene lower left corner "actual" latitude at for a full or a partial scene.
SCENE_LL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	WRS scene lower left corner "actual" longitude at for a full or a partial scene.
SCENE_LR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	WRS scene lower right corner "actual" latitude at for a full or a partial scene.
SCENE_LR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive value (+) indicates East longitude. A negative (-) value indicates West longitude.	WRS scene lower right corner "actual" longitude at for a full or a partial scene.
SCENE_CCA	1-3	= 0-100 This field is included in the ETM+ Format 1 metadata only.	WRS scene cloud cover assessment (CCA) - Indicates the percent of a WRS scene area covered with clouds. This CCA is an average of the quadrants CCA scores

UL_QUAD_CCA	1-3	<p>= 0-100, or = "N/A" for a missing quadrant in a partial scene</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	Indicates the percent of upper left quadrant of the WRS scene area covered with clouds.
UR_QUAD_CCA	1-3	<p>= 0-100, or = "N/A" for a missing quadrant in a partial scene</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	Indicates the percent of upper right quadrant of the WRS scene area covered with clouds.
LL_QUAD_CCA	1-3	<p>= 0-100, or = "N/A" for a missing quadrant in a partial scene</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	Indicates the percent of lower left quadrant of the WRS scene area covered with clouds.
LR_QUAD_CCA	1-3	<p>= 0-100, or = "N/A" for a missing quadrant in a partial scene</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	Indicates the percent of lower right quadrant of the WRS scene area covered with clouds.
ACCA_ALGORITHM_ID_VER	22	<p>= 22 ASCII characters</p> <p>The algorithm name and version numbers are determined by the Landsat 7 Project.</p>	Identifies the ACCA algorithm (name and version number), used by LPS to compute the cloud cover score for this scene.
SUN_AZIMUTH_ANGLE	12	<p>= -180.0000000 through +180.0000000 degrees (with 7-digit precision)</p> <p>A positive value (+) indicates angles to the East or clockwise from North. A negative value (-) indicates angles to the West or counterclockwise from North.</p> <p>(Leading zeros are not required)</p>	The Sun azimuth angle at the "true" WRS scene center (LPS calculated from PCD processing).
SUN_ELEVATION_ANGLE	12	<p>= -90.0000000 through +90.0000000 degrees (with 7-digit precision)</p> <p>A positive value (+) indicates a daytime scene. A negative value (-) indicates a nighttime scene.</p> <p>(Leading zeros are not required)</p>	The Sun elevation angle at the "true" WRS scene center (LPS calculated from PCD processing).

SCENE_BAND1_PRESENT	1	<p>= "Y" indicates that Band 1 is present OR = "N" indicates that Band 1 is not present = "U" indicates that Band 1 presence is unknown</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	<p>This is the "Band 1 ON" state information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 0, where a bit set condition. (=1) indicates "Band 1 ON state". The first error-free PCD major frame (2) associated with the scene is used to derive this value. If no valid PCD major frame falls within the scene's time boundary, then the value for the previous scene will be used. If the previous scene has no valid major frame (e.g., the first partial scene in a subinterval), then the value "U" for unknown is used.</p>
SCENE_BAND2_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	<p>Same as above with exception as noted. This is the "Band 2 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 1, where a bit set condition (=1) indicates "Band 2 ON state."</p>
SCENE_BAND3_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	<p>Same as above with exception as noted. This is the "Band 3 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 2, where a bit set condition (=1) indicates "Band 3 ON state."</p>
SCENE_BAND4_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	<p>Same as above with exception as noted. This is the "Band 4 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 3, where a bit set condition (=1) indicates "Band 4 ON state."</p>
SCENE_BAND5_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	<p>Same as above with exception as noted. This is the "Band 5 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 4, where a bit set condition (=1) indicates "Band 5 ON state."</p>
SCENE_BAND6_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 1 or Format 2 metadata.</p>	<p>Same as above with exception as noted. This is the "Band 6/MIR ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 5, where a bit set condition (=1) indicates "Band 6 ON state."</p>
SCENE_BAND7_PRESENT	1	<p>(Same as SCENE_BAND1_PRESENT values and format).</p> <p>This field is included in the ETM+ Format 2 metadata only.</p>	<p>Same as above with exception as noted. This is the "Band 7 ON" status information obtained from PCD Serial Word "B" (major frame (2), minor frame 32, word 72), bit 6, where a bit set condition (=1) indicates "Band 7 ON state."</p>

SCENE_BAND8_PRESENT	1	(Same as SCENE_BAND1_PRESENT values and format). This field is included in the ETM+ Format 2 metadata only.	Same as above with exception as noted. This is the "Band 8 ON" status information obtained from PCD Serial Word "E" (major frame (2), minor frame 35, word 72), bit 0, where a bit set condition (=1) indicates "Band 8 ON state."
BAND1_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 metadata only.	The band gain condition detected at the start of a WRS scene. This information is obtained from Words 7 and 8 of the PCD/Status Data field of the first error-free VCDU in a WRS scene.
BAND2_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_GAIN)
BAND3_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_GAIN)
BAND4_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_GAIN)
BAND5_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_GAIN)
BAND6_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 1 or Format 2 metadata.	(See parameter description for BAND1_GAIN)
BAND7_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 2 metadata only.	(See parameter description for BAND1_GAIN)
BAND8_GAIN	1	= "L" for a low gain condition or = "H" for a high gain condition This field is included in the ETM+ Format 2 metadata only.	(See parameter description for BAND1_GAIN)

BAND1_GAIN_CHANGE	1	<p>= "0" indicates no band gain change within scene or = "+" indicates a low to high band gain change within scene or = "-" indicates a high to low band gain change within scene</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	Band gain change flags are generated by LPS by evaluating corresponding band gain states in adjacent ETM+ scans (major frames).
BAND2_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND3_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND4_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND5_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND6_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 1 or Format 2 metadata.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND7_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 2 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND8_GAIN_CHANGE	1	<p>(Same as for BAND1_GAIN_CHANGE)</p> <p>This field is included in the ETM+ Format 2 metadata only.</p>	(See parameter description for BAND1_GAIN_CHANGE)
BAND1_SL_GAIN_CHANGE	1-5	<p>= NNNNN where: 0 = no gain change 1- 12000 = the scan line number where the first change in band gain was detected.</p> <p>This field is included in the ETM+ Format 1 metadata only.</p>	This field indicates the scan line number in the scene for the first change detected in the band gain condition.

BAND2_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND3_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND4_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND5_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 1 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND6_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 1 or Format 2 metadata.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND7_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 2 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
BAND8_SL_GAIN_CHANGE	1-5	(Same as for BAND1_SL_GAIN_CHANGE) This field is included in the ETM+ Format 2 metadata only.	(See parameter description for BAND1_SL_GAIN_CHANGE)
FULL_APERTURE_CAL_FLAG	1	= "N" indicates no full calibration activity during this scene OR = "Y" indicates a full calibration activity	This field indicates the ETM+ full calibration activity during this scene. The calibration door activity flag is interpolated from "serial word P" of the third PCD major frame, minor frame 83, word 72, bits 2 and 3.
DAY_NIGHT_FLAG	1	= "D" for day flag 'True' OR = "N" for night flag 'True'	This field indicates the day or night condition for the scene. The LPS determines the day/night condition of a scene by comparing the Sun elevation values against an angle value of 0 degrees. A scene is declared a day scene if the Sun elevation angle is greater than 0 degrees; otherwise it is declared a night scene.
END_GROUP	21	= WRS_SCENE_NN_METADATA where NN = 01-99 (Up to 35 scenes are expected to be received by LPS in a 14-minute subinterval)	End of the third level ODL group. It indicates the end of the ETM+ Format 1 or Format 2 WRS Scene Metadata group records.

Image Q&A Data (not an LPS metadata parameter)			The following parameter values are repeated for each WRS scene included in this subinterval.
GROUP	21	= WRS_SCENE_NN_ETM_QA where NN = 01–99	Beginning of the third level ODL group. It indicates the beginning of the ETM+ Format 1 or Format 2 Scene NN Q&A data group records.
CADUS_VCDUS_RECEIVED	1–6	= 1–999999	The total number of CADUs/VCDUs received for this scene. Approximately 362,380 VCDUs are expected to be received for a 26.8-second long WRS scene. A WRS scene consists of a maximum of 375, including 40 overlap scans.
FLY_WHEEL_CADUS	1–6	= 0–999999	The total number of CADUs fly-wheeled due to sync errors.
R-S_ERR_VCDUS	1–6	= 0–999999	The total number of VCDUs with Reed-Solomon error corrected in the header field.
BCH_CORRECTED_VCDUS	1–6	= 0–999999	The total number of VCDUs with BCH errors corrected for up to 3 bits in their mission data fields.
BCH_UNCORRECTED_VCDUS	1–6	= 0–999999	The total number of VCDUs containing uncorrected BCH errors (bits) in their mission data fields.
BIT_ERROR_RATE	1–4	= 0–9999 = "****" indicates a counter overflow (BIT_ERROR_RATE > 9999) for excessively noisy data.	The number of bit errors detected over the whole length of the scene and normalized to average number of errors in 100,000 bits. BIT_ERROR_RATE = (Total Detected Bit Errors/Total Number of Bits in Subinterval) x 100,000. This BER is calculated using bit errors detected (corrected or not) during CRC and BCH checks of the input VCDUs. An input data bit error rate of 1 in 100,000 or less is considered acceptable.
ETM+_TIMECODE_ERRORS	1–3	0–999 = "****" indicates a counter overflow (ETM+_TIMECODE_ERRORS > 999) for excessively noisy data.	The total number of ETM+ scans (major frames) detected with errors in their time code fields during processing of this subinterval scene. A maximum of 375 ETM+ scans are possible in a WRS scene.
ENTIRELY_FILLED_SCANS	1–3	0–999 = "****" indicates a counter overflow (ENTIRELY_FILLED_SCANS > 999) for excessively noisy data.	The total number of ETM+ major frames (maximum of 375) in this WRS scene (~26.8 seconds for 375 scans) that were entirely filled using a pre-determined fill data pattern.
PARTIALLY_FILLED_SCANS	1–3	0–999 = "****" indicates a counter overflow (PARTIALLY_FILLED_SCANS > 999) for excessively noisy data.	The total number of ETM+ major frames (maximum of 375) in this WRS scene that were partially filled using a pre-determined fill data pattern.

END_GROUP	21	= WRS_SCENE_NN_ETM_QA where NN = 01–99	End of the third level ODL group. It indicates the end of the ETM+ Q&A data group records for WRS Scene NN.
PCD Q&A Data (not an LPS metadata parameter)			The following parameter values are repeated for each WRS scene included in the subinterval.
GROUP	20	= WRS_SCENE_NN_PCD_QA where NN = 01–99	Beginning of the third level ODL group. It indicates the beginning of the PCD Q&A data group records for WRS Scene NN.
PCD_WORDS_RECEIVED	1–6	= 0–999999	The total number of PCD words, extracted from the unpacked PCD words (one sync byte, 3 repeated data bytes, and at least 4 fill bytes), received for this scene. Approximately 107,200 packed PCD words can be received by LPS for a 26.8-second scene.
PCD_BYTE_VOTING_ERR	1–6	= 0–999999	The total number of PCD words that encountered byte-voting errors during packing (for a maximum of 107,200 words).
TOTAL_PCD_MINOR_FRAMES	1–3	= 0–999	The total number of PCD minor frames constructed during this scene. Approximately 838 PCD minor frames can be received by LPS for a 26.8-second WRS scene.
PCD_MINOR_FRAME_ERR	1–3	= 1–999	The total number of PCD minor frames which encountered sync errors during their construction for a scene. Up to 838 minor frames for a WRS scene are expected.
FILLED_PCD_MINOR_FRAMES	1–3	= 1–999	The total number of PCD minor frames which required a data fill during their construction.
FILLED_PCD_MAJOR_FRAMES	1	= 0–9	The total number of PCD major frames which required a data fill during their construction. Approximately 7 major frames can be received by LPS for a 26.8-second long WRS scene.
END_GROUP	20	= WRS_SCENE_NN_PCD_QA where NN = 01–99	End of the third level ODL group. It indicates the end of the PCD Q&A data group records for WRS Scene NN.
Processed PCD Q&A Data (not an LPS metadata parameter)			The following parameter values are repeated for each WRS scene included in the subinterval.
GROUP	30	= WRS_SCENE_NN_PROCESSED_PCD_QA where NN = 01–99	Beginning of the third level ODL group. It indicates the beginning of the processed PCD Q&A data group records for WRS Scene NN.

TOTAL_ATTITUDE_POINTS	1	= 0–9	The total number of spacecraft attitude data points (quaternions) received and processed from the PCD associated with this scene. Approximately 6.5 spacecraft attitude data points can be received for a 26.8-second WRS scene.
REJECTED_ATTITUDE_POINTS	1	= 0–9	The total number of spacecraft attitude data points (quaternions) found to fail the PCD quality checks. The rejected data points are flagged and included in the PCD file associated with this WRS scene.
MISSING_ATTITUDE_POINTS	1	= 0–9	The total number of spacecraft attitude data points (quaternions) found missing during PCD quality checks. The missing data points are flagged and included in the PCD file associated with this WRS scene.
TOTAL_EPHEMERIS_POINTS	1	= 0–9	The total number of ephemeris data points received and processed from the PCD of this scene. Approximately 7 ephemeris data points can be received for a 26.8-second long WRS scene.
REJECTED_EPHEMERIS_POINTS	1	= 0–9	The total number of spacecraft ephemeris data points found to fail LPS PCD quality checks. The rejected data points are flagged and included in the PCD file associated with this WRS scene.
MISSING_EPHEMERIS_POINTS	1	= 0–9	The total number of spacecraft ephemeris data points found missing during PCD quality checks. The missing data points are flagged and included in the PCD file associated with this WRS scene.
END_GROUP	30	= WRS_SCENE_NN_PROCESSED_PCD_QA where NN = 01–99	End of the third level ODL group. It indicates the end of the processed PCD Q&A data group records for WRS Scene NN.
END_GROUP	26	= SCENE_NN_METADATA where NN = 01–99 (Up to 35 scenes are expected to be received by LPS in a 14-minute subinterval)	End of the second level ODL group. It indicates the end of the ETM+ Format 1 or Format 2 Scene NN level metadata group records.
END_GROUP	29	= SUBINTERVAL_METADATA_FMT_m m = 1 for Format 1 OR m = 2 for Format 2	End of the second level ODL group. It indicates the end of the ETM+ Format 1 or Format 2 subinterval level Metadata group records.

END_GROUP	22	= METADATA_FILE	End of the first level ODL group. It indicates the end of the LPS Metadata File Level Group records for an ETM+ Format 1 or Format 2 subinterval.
END			Required standalone parameter signifying file end

5.3.4.2 ECS Metadata

The third metadata file, also an external element, is created during product generation and contains information specific to the product ordered such as corner coordinates and external element file names. The full contents of the ECS metadata file are listed in Table 5.7.

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description / Remarks
GROUP	17	= ECS_METADATA_FILE	Beginning of the first level ODL group. It indicates the start of the ECS Metadata File Level Group
GROUP	18	= METADATA_FILE_INFO	Beginning of metadata file information group
PRODUCT_CREATION_DATE_TIME	20	= YYYY-MM-DDThh:mm:ssZ where YYYY = four digit Julian year (e.g., 1998 and 2001) MM = month number of a Julian year (01–12 for January to December) DD = day of a Julian month (01–31) T indicates the start of time information in the ODL ASCII time code format hh = hours (00–23) mm = minutes (00–59) ss = seconds (00–59) Z indicates "Zulu" time (same as GMT)	The ECS system date and time when the metadata file for a Level 0R product set was created. For ease of human readability, this date and time information is presented in the ODL ASCII format. The time is expressed as Universal Coordinated Time (also known as Greenwich Mean Time (GMT)). Insertion of additional characters "T" and "Z" is required to meet the ODL ASCII time format.
STATION_ID	3	= "EDC"	Unique 3 letter code identifying the origination ground station
L7_CPF_NAME	19	= L7YYYYDDDIASCAL.VNN where V = version identifier NN = sequence # for this file	Unique IAS assigned file name for the CPF included with a 0R product.
END_GROUP	18	= METADATA_FILE_INFO	End of the metadata information group
GROUP	16	= PRODUCT_METADATA	Beginning of the product metadata group
SPACECRAFT_ID	8	= "Landsat7"	Name of the satellite platform
SENSOR_ID	4	= "ETM+"	Name of the imaging sensor

Table 5.7: ECS Product Metadata File Contents - ODL Parameter Values

Table 5.7: ECS Product Metadata File Contents - ODL Parameter Values (cont.)

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description / Remarks
ACQUISITION_DATE	10	YYYY-MM-DDThh:mm:ssZ where (see data & time convention above)	Date the image was acquired
WRS_PATH	3	= NNN, where NNN = path number	WRS path value for product
STARTING_ROW	3	= NNN, where NNN = row of the first full or partial scene in the product	Starting WRS row
ENDING_ROW	3	= NNN, where NNN = row of the last full or partial scene in the product	Ending WRS row
NUMBER_OF_SCANS	5	= NNNNN, where NNNNN = 90 - 12410	Total number of scans in the product
TOTAL_WRS_SCENES	2	= NN, where NN = the number of full or partial scenes encapsulated by the product	Maximum number is 36 for a subinterval product
BAND_COMBINATION	9	NNNNNNNNN where NNNNNNNNN = e.g. 123456678 for all bands present, 123-----8 for bands 1,2,3,8. A '-' is a position holder for absent bands	ECS generated bands present indicator for the product ordered. The first 6 is format 1 band 6 The second 6 is format 2 band 6
PRODUCT_UL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision) A positive (+) value indicates North latitude. A negative (-) value indicates South latitude.	ECS calculated "actual" latitude value for the upper left corner of the product.
PRODUCT_UL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision) A positive sign (+) indicates East longitude. A negative (-) value indicates West longitude.	ECS calculated "actual" longitude value for the upper left corner of the product.
PRODUCT_UR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	ECS calculated "actual" latitude value for the upper right corner of the product.
PRODUCT_UR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	ECS calculated "actual" longitude value for the upper right corner of the product.
PRODUCT_LL_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	ECS calculated "actual" latitude value for the lower left corner of the product.
PRODUCT_LL_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	ECS calculated "actual" longitude value for the lower left corner of the product.
PRODUCT_LR_CORNER_LAT	8	= -90.0000 through +90.0000 degrees (with a 4-digit precision)	ECS calculated "actual" latitude value for the lower right corner of the product.
PRODUCT_LR_CORNER_LON	9	= -180.0000 through +180.0000 degrees (with a 4-digit precision)	ECS calculated "actual" longitude value for the lower right corner of the product.
BAND_1_FILE_NAME	12	L7XsssfnYYDOYHHuuu_B10.xxx where L7XsssfnYYDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 1

Table 5.7: ECS Product Metadata File Contents - ODL Parameter Values (cont.)

Parameter Name	Size (ASCII Bytes)	Value, Format, Range, and Units	Parameter Description / Remarks
BAND_2_FILE_NAME	12	L7XsssfYDDOYHHuuv_B20.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 2
BAND_3_FILE_NAME	12	L7XsssfYDDOYHHuuv_B30.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 3
BAND_4_FILE_NAME	12	L7XsssfYDDOYHHuuv_B40.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 4
BAND_5_FILE_NAME	12	L7XsssfYDDOYHHuuv_B50.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 5
BAND_6F1_FILE_NAME	12	L7XsssfYDDOYHHuuv_B60.xxx where L7Xss2nYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 6, format 1
BAND_6F2_FILE_NAME	12	L7Xss2nYDDOYHHuuv_B60.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 6, format 2
BAND_7_FILE_NAME	12	L7XsssfYDDOYHHuuv_B70.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 7
BAND_8_FILE_NAME	12	L7Xss2nYDDOYHHuuv_B80.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for band 8. The file extensions precursors B81, B82, B83, are used for a band 8 that spans multiple files.
IC_DATA_F1_FILE_NAME	12	“L7XsssfYDDOYHHuuv_CAL.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 1 internal calibrator data
IC_DATA_F2_FILE_NAME	12	“L7XsssfYDDOYHHuuv_CAL.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 2 internal calibrator data
SCAN_OFFSETS_F2_NAME	12	“L7XsssfYDDOYHHuuv_SLO.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 1 scan line shifts
SCAN_OFFSETS_F1_NAME	12	“L7XsssfYDDOYHHuuv_SLO.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 2 scan line shifts
MSCD_F1_FILE_NAME	12	“L7XsssfYDDOYHHuuv_MSD.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 1 MSCD

MSCD_F2_FILE_NAME	12	“L7XsssfYDDOYHHuuv_MSD.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 2 MSCD
PCD_F1_FILE_NAME	12	“L7XsssfYDDOYHHuuv_PCD.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 1 PCD
PCD_F2_FILE_NAME	12	“L7XsssfYDDOYHHuuv_PCD.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for format 2 PCD
METADATA_F1_FILE_NAME	12	“L7XsssfYDDOYHHuuv_MTA.xxx” where L7Xss1nYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for ECS format 1 metadata
METADATA_F2_FILE_NAME	12	“L7XsssfYDDOYHHuuv_MTA.xxx” where L7Xss2nYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for ECS format 2 metadata
METADATA_PS_FILE_NAME	12	L7XsssfYDDOYHHuuv_MTP.xxx” where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for ECS product specific metadata
CPF_FILE_NAME	12	L7XsssfYDDOYHHuuv_CPF.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for IAS Calibration Parameter File
GEOLOCATION_FILE_NAME	12	L7XsssfYDDOYHHuuv_GEO.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated external element file name for the geolocation table
HDF_FILE_NAME	12	L7XsssfYDDOYHHuuv_HDF.xxx where L7XsssfYDDOYHH = (see 5.3.2 for details), xxx = ECS generated extension	ECS generated file name for the HDF directory file
END_GROUP	16	= PRODUCT_METADATA	End of the product metadata group
END_GROUP	22	= ECS_METADATA_FILE	End of the ECS product metadata ODL group
END			Required standalone parameter signifying file end

Table 5.7 ECS Product Metadata File Contents - ODL Parameter Values

5.3.4.3 ODL Conventions

All metadata is stored as ASCII text using the ODL syntax developed by the Jet Propulsion Laboratory. ODL is a tagged keyword language that was developed to provide a human readable data structure to encode data for simplified interchange. Parameters defined by the ODL syntax can be logically grouped to aid in file organization and efficient parsing by software interpreters. ODL details can be found in applicable document 1.4.5.

The ODL syntax employs the following conventions:

- Parameter definition is in the form of Parameter = Value.
- There is one Parameter definition per line.

- Blank spaces and lines are ignored.
- A carriage return <CR> and line feed <LF> ends each line in the file.
- Each line of comments must begin with the character /* and end with the character */,
including comments embedded on the same line as a Parameter definition.
- Quotation marks are required for Values that are text strings, including single characters.
The exceptions to this rule are the GROUP , END_GROUP , OBJECT, END_OBJECT
Identifiers or Values, which do not use quotation marks.
- Case is not significant, but upper case is used for Parameter and Group names to aid
in readability.
- Indentation is not significant, but is used for readability.
- The reserve word END concludes the file.

5.3.4.4 ODL Examples

The three metadata files included in a 0R product conform to the ODL standard. Table 5-6 provides details on LPS parameter values and their formats used to construct the ETM+ Format 1 and Format 2 metadata files. Table 5-7 provides similar details for building the ECS 0R product metadata file. In accordance with the ODL standard, all parameters and values are presented using ASCII standard characters.

Examples of the three ODL metadata files follow. The GROUP keyword and names are presented as bold text for illustration purposes only. In addition, the comment statements enclosed within "/*" and "*/" are shown to clarify the metadata format construction. They can be used but are not required in the ODL metadata file format.

5.3.4.4.1 HDF ODL Example - Format 1 Metadata File

Format 1 metadata is organized into subinterval and scene groups. A scene group exists for each scene in the subinterval.

```

/*    LPS Level 0R subinterval - format 1 metadata file - Format 1    */

GROUP = METADATA_FILE;

/*  Metadata file identification - Format 1  */

GROUP = METADATA_FILE_INFO
  FILE_NAME = L71EDC119813511010.MTA
  FILE__CREATION__DATE__TIME = 1998-05-15T13:30:25Z
  FILE_VERSION_NO = 0
  STATION_ID = "EDC"
  SOFTWARE_VERSION_NO = NNNNN
  L7_CAL_PARAM_FILE_VERSION_NO = 10
END_GROUP = METADATA_FILE_INFO

/* Subinterval level metadata - Format 1 */

GROUP = SUBINTERVAL_METADATA_FMT_1
  SPACECRAFT_ID = "Landsat7"
  SENSOR_ID = "ETM+"
  CONTACT_PERIOD_START_TIME = 1998:135:11:23:10
  CONTACT_PERIOD_STOP_TIME = 1998:135:11:37:01
  WRS_PATH = 029

```



```

STARTING_ROW = 020
ENDING_ROW = 045
PRODUCT_START_TIME = 1998:135:11:25:01.1234567
PRODUCT_STOP_TIME = 1998:135:11:35:05.7654321
TOTAL_ETM+_SCANS = 8853
PCD_START_TIME = 1998:135:11:25:01.1234567
PCD_STOP_TIME = 1998:135:11:35:05.7654321
TOTAL_PCD_MAJOR_FRAMES = 147
PRODUCT_UL_CORNER_LAT = +41.5432      /* Sample Results are */
PRODUCT_UL_CORNER_LON = -96.5432      /* shown; not related*/
PRODUCT_UR_CORNER_LAT = +41.4321      /* to other results */
PRODUCT_UR_CORNER_LON = -96.6543      /* included in this */
PRODUCT_LL_CORNER_LAT = -41.4532      /* Example */
PRODUCT_LL_CORNER_LON = -96.3543
PRODUCT_LR_CORNER_LAT = +41.3432
PRODUCT_LR_CORNER_LON = -96.6543
ETM+_LAST_ON_TIME = 1998:135:11:20:01.1234567
ETM+_LAST_OFF_TIME = 1998:135:09:25:01.7654321
UT1_CORRECTION = +0.12345
BAND1_PRESENT = "Y"
BAND2_PRESENT = "Y"
BAND3_PRESENT = "Y"
BAND4_PRESENT = "Y"
BAND5_PRESENT = "Y"
BAND6_PRESENT = "Y"
TOTAL_WRS_SCENES = 26
PARTIAL_WRS_SCENES = 2
TOTAL_FILES = 35
BAND1_FILE_NAME = "L71EDC119813511010.B10"
BAND2_FILE_NAME = "L71EDC119813511010.B20"
BAND3_FILE_NAME = "L71EDC119813511010.B30"
BAND4_FILE_NAME = "L71EDC119813511010.B40"
BAND5_FILE_NAME = "L71EDC119813511010.B50"
BAND6_FILE_NAME = "L71EDC119813511010.B60"
MSCD_FILE_NAME = "L71EDC119813511010.MSD"
PCD_FILE_NAME = "L71EDC119813511010.PCD"
CAL_FILE_NAME = "L71EDC119813511010.CAL"

```

/* Metadata for all WRS scenes included in the Format 1 subinterval */
/* Note: The WRS scene centers correspond to Band 1 scan times */

GROUP = SCENE_01_METADATA

GROUP = WRS_SCENE_01_METADATA

```

WRS_SCENE_NO = 1
FULL_OR_PARTIAL_SCENE = "P"
BROWSE_FILE_NAME = L71EDC119813511010.R01
WRS_PATH = 029
WRS_ROW = 020
SCENE_CENTER_SCAN_NO = 0

```

```

SCENE_CENTER_SCAN_TIME = 1998:135:11:26:45.1234567
SCENE_CENTER_LAT = +42.1234
SCENE_CENTER_LON = -96.7654
HORIZONTAL_DISPLAY_SHIFT = +275
SCENE_UL_CORNER_LAT = +41.5432
SCENE_UL_CORNER_LON = -96.5432
SCENE_UR_CORNER_LAT = +41.4321
SCENE_UR_CORNER_LON = -96.6543
SCENE_LL_CORNER_LAT = +41.6543
SCENE_LL_CORNER_LON = -96.3543
SCENE_LR_CORNER_LAT = +41.3432
SCENE_LR_CORNER_LON = -96.6543
SCENE_CCA = 52
UL_QUAD_CCA = 99
UR_QUAD_CCA = 99
LL_QUAD_CCA = 4
LR_QUAD_CCA = 6
ACCA_ALGORITHM_ID_VER = "ACCA_11MAY98_9999E.ALG"
SUN_AZIMUTH_ANGLE = +20.1234567
SUN_ELEVATION_ANGLE = +20.1234567
SCENE_BAND1_PRESENT = "Y"
SCENE_BAND2_PRESENT = "Y"
SCENE_BAND3_PRESENT = "Y"
SCENE_BAND4_PRESENT = "Y"
SCENE_BAND5_PRESENT = "Y"
SCENE_BAND6_PRESENT = "Y"
BAND1_GAIN = "H"
BAND2_GAIN = "H"
BAND3_GAIN = "H"
BAND4_GAIN = "H"
BAND5_GAIN = "H"
BAND6_GAIN = "L"
BAND1_GAIN_CHANGE = "0"
BAND2_GAIN_CHANGE = "0"
BAND3_GAIN_CHANGE = "0"
BAND4_GAIN_CHANGE = "0"
BAND5_GAIN_CHANGE = "-"
BAND6_GAIN_CHANGE = "0"
BAND1_SL_GAIN_CHANGE = 0
BAND2_SL_GAIN_CHANGE = 0
BAND3_SL_GAIN_CHANGE = 0
BAND4_SL_GAIN_CHANGE = 0
BAND5_SL_GAIN_CHANGE = 9000
BAND6_SL_GAIN_CHANGE = 0
FULL_APERTURE_CAL_FLAG = "N"
DAY_NIGHT_FLAG = "D"
END_GROUP = WRS_SCENE_01_METADATA

```

/* Scene image data quality and accounting (Q&A) data */

```

GROUP = WRS_SCENE_01_ETM+_QA
  CADUS_VCDUS_RECEIVED = 543926
  FLYWHEEL_CADUS = 123456
  R-S_ERR_VCDUS = 123
  BCH_CORRECTED_VCDUS = 456
  BCH_UNCORRECTED_VCDUS = 12
  BIT_ERROR_RATE = 10
  ETM+_TIMECODE_ERRORS = 12
  ENTIRELY_FILLED_SCANS = 12
  PARTIALLY_FILLED_SCANS = 123
END_GROUP = WRS_SCENE_01_ETM_QA

```

/* Scene PCD quality and accounting information */

```

GROUP = WRS_SCENE_01_PCD_QA
  PCD_WORDS_RECEIVED = 106340
  PCD_BYTE_VOTING_ERR = 106
  TOTAL_PCD_MINOR_FRAMES = 202
  PCD_MINOR_FRAME_ERR = 202
  FILLED_PCD_MINOR_FRAMES = 200
  FILLED_PCD_MAJOR_FRAMES = 1
END_GROUP = WRS_SCENE_01_PCD_QA

```

/* Processed PCD quality and accounting information on scene */

```

GROUP = WRS_SCENE_01_PROCESSED_PCD_QA
  TOTAL_ATTITUDE_POINTS = 6
  REJECTED_ATTITUDE_POINTS = 1
  MISSING_ATTITUDE_POINTS = 1
  TOTAL_EPHEMERIS_POINTS = 6
  REJECTED_EPHEMERIS_POINTS = 1
  MISSING_EPHEMERIS_POINTS = 1
END_GROUP = WRS_SCENE_01_PROCESSED_PCD_QA

```

```

END_GROUP = SCENE_01_METADATA

```

- /* Repeat SCENE_NN_METADATA GROUP until NN > 26, */
- /* the total number of WRS scenes, full or partial, present in this */
- /* subinterval example */

```

GROUP = SCENE_NN_METADATA          /* Scene NN Metadata ODL group */

```

```

END_GROUP = SCENE_NN_METADATA

```

```

END_GROUP = SUBINTERVAL_METADATA_FMT_1

```

```

END_GROUP = METADATA_FILE

```

```

END

```

5.3.4.4.2 HDF ODL Example - Format 2 Metadata File

Format 2 metadata is organized into subinterval and scene groups. A scene group exists for each scene in the subinterval.

```

/* LPS Level 0R subinterval - format 1 metadata file - Format 2 */

GROUP = METADATA_FILE

/* Metadata file identification - Format 2 */

GROUP = METADATA_FILE_INFO
  File_NAME = L71EDC229813511010.MTA
  FILE__CREATION__DATE__TIME = 1998-05-15T13:30:26Z
  FILE_VERSION_NO = 0
  STATION_ID = "EDC"
  SOFTWARE_VERSION_NO = NNNNN
  L7_CAL_PARAM_FILE_VERSION_NO = 10
END_GROUP = METADATA_FILE_INFO

/* PRODUCT level metadata - Format 2 */

GROUP = SUBINTERVAL_METADATA_FMT_2
  SPACECRAFT_ID = "Landsat7"
  SENSOR_ID = "ETM"
  CONTACT_PERIOD_START_TIME = 1998:135:11:23:10
  CONTACT_PERIOD_STOP_TIME = 1998:135:11:37:01
  WRS_PATH = 029

  STARTING_ROW = 020
  ENDING_ROW = 045
  PRODUCT_START_TIME = 1998:135:11:25:01.1234567
  PRODUCT_STOP_TIME = 1998:135:11:35:05.7654321
  TOTAL_ETM_SCANS = 8853
  PCD_START_TIME = 1998:135:11:25:01.1234567
  PCD_STOP_TIME = 1998:135:11:35:05.7654321
  TOTAL_PCD_MAJOR_FRAMES = 147
  PRODUCT_UL_CORNER_LAT = +41.5432
  PRODUCT_UL_CORNER_LON = -96.5432
  PRODUCT_UR_CORNER_LAT = +41.4321
  PRODUCT_UR_CORNER_LON = -96.6543
  PRODUCT_LL_CORNER_LAT = -96.6543
  PRODUCT_LL_CORNER_LON = -96.3543
  PRODUCT_LR_CORNER_LAT = +41.3432
  PRODUCT_LR_CORNER_LON = -96.6543
  ETM_LAST_ON_TIME = 1998:135:11:15:01.1234567
  ETM_LAST_OFF_TIME = 1998:135:09:25:01.7654321
  UT1_CORRECTION = +0.1234567
  BAND6_PRESENT = "Y"

```

/* Sample Results are shown */
 /* not related to other results */
 /* included in this Example */

```

BAND7_PRESENT = "Y"
BAND8_PRESENT = "Y"
TOTAL_WRS_SCENES = 25
PARTIAL_WRS_SCENES = 2
TOTAL_FILES = 8
BAND6_FILE_NAME = "L71EDC119813511010.B60"
BAND7_FILE_NAME = "L71EDC119813511010.B70"
BAND8_FILE_1_NAME = "L71EDC119813511010.B81"
BAND8_FILE_2_NAME = "L71EDC119813511010.B82"
BAND8_FILE_3_NAME = "L71EDC119813511010.B83"
MSCD_FILE_NAME = "L71EDC119813511010.MSD"
PCD_FILE_NAME = "L71EDC119813511010.PCD"
CAL_FILE_NAME = "L71EDC119813511010.CAL"

```

/* WRS scene-by-scene metadata for this Level 0R subinterval */

/* Note: The WRS scene centers correspond to Band 7 scan times */

GROUP = SCENE_01_METADATA

GROUP = WRS_SCENE_01_METADATA

```

WRS_SCENE_NO = 1
FULL_OR_PARTIAL_SCENE = "P"
WRS_PATH = 029
WRS_ROW = 020
SCENE_CENTER_SCAN_NO = 0
SCENE_CENTER_SCAN_TIME = 1998:135:11:26:45.1234567
SCENE_CENTER_LAT = +42.1234
SCENE_CENTER_LON = -96.7654
HORIZONTAL_DISPLAY_SHIFT = +275
SCENE_UL_CORNER_LAT = +41.5432
SCENE_UL_CORNER_LON = -96.5432
SCENE_UR_CORNER_LAT = +41.4321
SCENE_UR_CORNER_LON = -96.6543
SCENE_LL_CORNER_LAT = +41.6543
SCENE_LL_CORNER_LON = -96.3543
SCENE_LR_CORNER_LAT = +41.3434
SCENE_LR_CORNER_LON = -96.6543
SUN_AZIMUTH_ANGLE = +20.1234567
SUN_ELEVATION_ANGLE = +20.1234567
SCENE_BAND6_PRESENT = "Y"
SCENE_BAND7_PRESENT = "Y"
SCENE_BAND8_PRESENT = "Y"
BAND6_GAIN = "H"
BAND7_GAIN = "H"
BAND8_GAIN = "H"
BAND6_GAIN_CHANGE = "0"
BAND7_GAIN_CHANGE = "-"
BAND8_GAIN_CHANGE = "0"
BAND6_SL_GAIN_CHANGE = 0

```

```

BAND7_SL_GAIN_CHANGE = 9000
BAND8_SL_GAIN_CHANGE = 0
FULL_APERTURE_CAL_FLAG = "N"
DAY_NIGHT_FLAG = "D"
END_GROUP = WRS_SCENE_01_METADATA

```

/* Scene Image Data quality and accounting (Q&A) data */

```

GROUP = WRS_SCENE_01_ETM_QA
CADUS_VCDUS_RECEIVED = 543926
FLYWHEEL_CADUS = 123456
R-S_ERR_VCDUS = 123
BCH_CORRECTED_VCDUS = 456
BCH_UNCORRECTED_VCDUS = 12
BIT_ERROR_RATE = 99
ETM_TIMECODE_ERRORS = 12
ENTIRELY_FILLED_SCANS = 12
PARTIALLY_FILLED_SCANS = 123
END_GROUP = WRS_SCENE_01_ETM_QA

```

/* Scene PCD quality and accounting information */

```

GROUP = WRS_SCENE_01_PCD_QA
PCD_WORDS_RECEIVED = 106341
PCD_BYTE_VOTING_ERR = 106
TOTAL_PCD_MINOR_FRAMES = 202
PCD_MINOR_FRAME_ERR = 202
FILLED_PCD_MINOR_FRAMES = 199
FILLED_PCD_MAJOR_FRAMES = 1
END_GROUP = WRS_SCENE_01_PCD_QA

```

/* Processed PCD quality and accounting information on scene */

```

GROUP = WRS_SCENE_01_PROCESSED_PCD_QA
TOTAL_ATTITUDE_POINTS = 6
REJECTED_ATTITUDE_POINTS = 1
MISSING_ATTITUDE_POINTS = 1
TOTAL_EPHEMERIS_POINTS = 6
REJECTED_EPHEMERIS_POINTS = 1
MISSING_EPHEMERIS_POINTS = 1
END_GROUP = WRS_SCENE_01_PROCESSED_PCD_QA

```

```

END_GROUP = SCENE_01_METADATA

```

- /* Repeat SCENE_NN_METADATA GROUP until NN > 26, */
- /* the total number of WRS scenes, full or partial, present in this */
- /* subinterval example */

```
GROUP = SCENE_NN_METADATA
```

```
/* Scene NN Metadata ODL group */
```

```
END_GROUP = SCENE_NN_METADATA
```

```
END_GROUP = SUBINTERVAL_METADATA_FMT_2
```

```
END_GROUP = METADATA_FILE
```

```
END
```

5.3.4.4.3 HDF ODL Example - ECS Metadata File

This file is organized into information about the file and information about the product.

```
/* Landsat 7 ECS Product Metadata Format */
```

```
/*-----*/
```

```
/* Metadata File Header */
```

```
/*-----*/
```

```
BEGIN_GROUP=ECS_METADATA_FILE
```

```
BEGIN_GROUP=METADATA_FILE_INFO
```

```
Product_Creation_Date_Time = "1998-06-04T11:36:48Z"
```

```
Station_ID = "EDC"
```

```
L7_CPF_Name = "L71998001IASCAL.A01"
```

```
END_GROUP=METADATA_FILE_INFO
```

```
/*-----*/
```

```
/* Product Metadata */
```

```
/*-----*/
```

```
BEGIN_GROUP = PRODUCT_METADATA
```

```
Spacecraft_ID = "Landsat7"
```

```
Sensor_ID = "ETM+"
```

```
Acquisition_Date = "YYYY-MM-DDThh:mm:ssZ"
```

```
WRS_Path = 0032
```

```
Starting_Row = 036
```

```
Ending_Row = 037
```

```
Total_WRS_Scenes = 2
```

```
Number_Of_Scans = 744
```

```
Starting_Subinterval_Scan = 3000
```

```
Ending_Subinterval_Scan = 3743
```

```
Band_Combination = "123456678"
```

```
Product_UL_Corner_Lat = 35.4950
```

```
Product_UL_Corner_Lon = -105.2278
```

```

Product_UR_Corner_Lat = 35.2036
Product_UR_Corner_Lon = -103.2219
Product_LL_Corner_Lat = 32.5736
Product_LL_Corner_Lon = -106.0103
Product_LR_Corner_Lat = 32.292
Product_LR_Corner_Lon = -104.0697
Band1_File_Name = "L7XsssfYDDOYHHuuv_B10.xxx"
Band2_File_Name = "L7XsssfYDDOYHHuuv_B20.xxx"
Band3_File_Name = "L7XsssfYDDOYHHuuv_B30.xxx"
Band4_File_Name = "L7XsssfYDDOYHHuuv_B40.xxx"
Band5_File_Name = "L7XsssfYDDOYHHuuv_B50.xxx"
Band6_F1_File_Name = "L7XsssfYDDOYHHuuv_B61.xxx"
Band6_F2_File_Name = "L7XsssfYDDOYHHuuv_B62.xxx"
BAND_7_File_Name = "L7XsssfYDDOYHHuuv_B70.xxx"
BAND_8_File_Name = "L7XsssfYDDOYHHuuv_B80.xxx"
IC_Data_F1_File_Name = "L7XsssfYDDOYHHuuv_CAL.xxx"
IC_Data_F2_File_Name = "L7XsssfYDDOYHHuuv_CAL.xxx"
Scan_Offsets_F1_File_Name = "L7XsssfYDDOYHHuuv_SLO.xxx"
Scan_Offsets_F1_File_Name = "L7XsssfYDDOYHHuuv_SLO.xxx"
MSCD_Data_F1_File_Name = "L7XsssfYDDOYHHuuv_MSD.xxx"
MSCD_Data_F2_File_Name = "L7XsssfYDDOYHHuuv_MSD.xxx"
PCD_Data_F1_File_Name = "L7XsssfYDDOYHHuuv_PCD.xxx"
PCD_Data_F2_File_Name = "L7XsssfYDDOYHHuuv_PCD.xxx"
MetaData_F1_File_Name = "L7XsssfYDDOYHHuuv_MTA.xxx"
MetaData_F2_File_Name = "L7XsssfYDDOYHHuuv_MTA.xxx"
MetaData_PS_File_Name = "L7XsssfYDDOYHHuuv_MTP.xxx"
CPF_File_Name = "L7XsssfYDDOYHHuuv_CPF.xxx"
Geolocation_File_Name = "L7XsssfYDDOYHHuuv_GEO.xxx"
HDF_File_Name = "L7XsssfYDDOYHHuuv_HDF.xxx"

```

END_GROUP = PRODUCT_METADATA

END_GROUP = ECS_METADATA_FILE

END

5.3.5 Attribute Definitions - Calibration Parameter File

The calibration parameter file will be stored as text blocks in HDF attributes using the ODL syntax. A description of this file currently exists in a separate document which can be found on the IAS document server (<http://ltpwww.gsfc.nasa.gov/IAS/index.html>). It will be included here once the file is baselined.

5.3.6 Vgroup Definitions

The Vgroup structure was designed to associate related HDF data objects. Any HDF data object (e.g. Vdata, SDSs, attributes) can be included in an HDF Vgroup definition. Vgroups employ **Vgroup names** and **Vgroup classes** for characterizing a collection of data objects and for searching purposes. Three classes are recognized for the OR product; image data, correction data, and metadata.

The HDF Vgroup interface consists of routines for accessing and getting information about the OR product Vgroups. This information is stored in the HDF Data Directory.

The Vgroups used to relate the different component or data objects comprise a complete Level 0R scene product are presented in table 5.8.

Vgroup Name	Vgroup Class	Data Object Contents		Description
		Object Name	Type	
Scene_Data_30m	Image_Data	L7sss1nYYDOYHHuuv.B10	SDS	ETM+ band 1 30m data
		L7sss1nYYDOYHHuuv.B20	SDS	ETM+ band 2 30m data
		L7sss1nYYDOYHHuuv.B30	SDS	ETM+ band 3 30m data
		L7sss1nYYDOYHHuuv.B40	SDS	ETM+ band 4 30m data
		L7sss1nYYDOYHHuuv.B50	SDS	ETM+ band 5 30m data
		L7sss2nYYDOYHHuuv.B70	SDS	ETM+ band 7 30m data
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
Scene_Data_60m	Image_Data	L7sss1nYYDOYHHuuv.B60	SDS	ETM+ band 6 60m low gain data
		L7sss2nYYDOYHHuuv.B60	SDS	ETM+ band 6 60m high gain data
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
Scene_Data_15m	Image_Data	L7sss2nYYDOYHHuuv.B80	SDS	ETM+ band 8 15m data, one segment product (< 12 scenes)
		L7sss2nYYDOYHHuuv.B81	SDS	ETM+ band 8 15m data, two or more segment product
		L7sss2nYYDOYHHuuv.B82	SDS	ETM+ band 8 15m data, two or more segment product
		L7sss2nYYDOYHHuuv.B83	SDS	ETM+ band 8 15m data, three segment product
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
IC_Data_30m	Calibration_Data	L7sss1nYYDOYHHuuv.C10	SDS	IC data band 1 30m
		L7sss1nYYDOYHHuuv.C20	SDS	IC data band 2 30m
		L7sss1nYYDOYHHuuv.C30	SDS	IC data band 3 30m
		L7sss1nYYDOYHHuuv.C40	SDS	IC data band 4 30m
		L7sss1nYYDOYHHuuv.C50	SDS	IC data band 5 30m
		L7sss2nYYDOYHHuuv.C70	SDS	IC data band 7 30m
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
IC_Data_60m	Calibration_Data	L7sss1nYYDOYHHuuv.C60	SDS	IC data band 6 60m - low gain
		L7sss2nYYDOYHHuuv.C60	SDS	IC data band 6 60m - high gain
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
IC_Data_15m	Calibration_Data	L7sss2nYYDOYHHuuv.B80	SDS	IC data band 8 30m data
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
Scan_Line_Offsets_30m	Correction_Data	L7sss1nYYDOYHHuuv.SLO	Vdata	Scan line offsets band 1
		L7sss1nYYDOYHHuuv.O10	Vdata	Scan line offsets band 2
		L7sss1nYYDOYHHuuv.O20	Vdata	Scan line offsets band 3
		L7sss1nYYDOYHHuuv.O30	Vdata	Scan line offsets band 4
		L7sss1nYYDOYHHuuv.O40	Vdata	Scan line offsets band 5
		L7sss2nYYDOYHHuuv.O50	Vdata	Scan line offsets band 7
		L7sss2nYYDOYHHuuv.O70	Vdata	Geolocation Table
		L7sss1nYYDOYHHuuv.O60	Vdata	Scan line offsets band 6 low
Scan_Line_Offsets_60m	Correction_Data	L7sss2nYYDOYHHuuv.O60	Vdata	Scan line offsets band 6 high
		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
Scan_Line_Offsets_15m	Correction_Data	L7sss2nYYDOYHHuuv.O80	Vdata	Scan line offsets band 8

		L7sss1nYYDOYHHuuv.GEO	Vdata	Geolocation Table
PCD	Correction_Data	L7sss1nYYDOYHHuuv.PCD	Vdata	PCD - format 1
		L7sss2nYYDOYHHuuv.PCD	Vdata	PCD - format 2
MSCD	Correction_Data	L7sss1nYYDOYHHuuv.MSD	Vdata	MSCD - format 1
		L7sss2nYYDOYHHuuv.MSD	Vdata	MSCD - format 2
Product_Metadata	Metadata	L7sss1nYYDOYHHuuv.MTA	Attribute	Metadata - format 1
		L7sss2nYYDOYHHuuv.MTA	Attribute	Metadata - format 2
		L7sss1nYYDOYHHuuv.MTP	Attribute	Metadata - product specific
CPF	Parameter_Data	L7YYYYDDDIASCAL.VNN	Attribute	IAS Calibration Parameter File

Table 5.8 Vgroup definition for the Landsat 7 0R product

6.0 PRODUCT PACKAGING - in work

Content, Rationale, File arrangement on streamed devices.

7.0 HDF LICRARY - in work

8.0 EXAMPLE HDF PROGRAMS - in work

1. data directory listing
2. metadata listing
3. 0R external element read examples

9.0 ACRONYM LIST

CPF	Calibration Parameter File
EDC-DAAC	EROS Data Center Distributed Active Archive Center
EROS	Earth Resources Observation Systems
EOL	End of Line
EOS	Earth Observing System
Cal	Enhanced Thematic Mapper Plus
FAC	Full Aperture Calibrator
HDF	Heirarchical Data Format
IAS	Image Assessment System
IC	Internal Calibrator
ISO	International Organization for Standardization
IEEE	Institute of Electrical and Electronics Engineers
LGS	Landsat Ground Station
ECS	Landsat Processing System
MSCD	Mirror Scan Correction Data
NCSA	National Center for Supercomputing Applications
OCC	Onboard Calibrator
ODL	Object Description Language
PCD	Payload Correction Data
SDS	Scientific Data Set
SLO	Scan Line Offsets

WRS Worldwide Reference System